THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIV. No. 1648.] LONDON, DECEMBER 11, 1894. [46TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.

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SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

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Special Quotations to Gas Companies.

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Lanemark Coal Co.,

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Quotations and Analysis on application to

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NEW HIGH-POWER GAS-LIGHT.

INCANDESCENT GAS-LIGHT SYSTEM.

Consumes 3¾ cubic feet per hour.

Gives a light of 70 to 80 candle power.

Brilliant Light.

Perfectly Steady and Noiseless.

Smokeless.

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The Ordinary Burner, with Special Globes, is suitable for Lighting Private Houses, Public Houses, Restaurants, Shops, &c.

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Speciality: PATENT CASH PREPAYMENT METERS.

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Fig. 600. "CORNISH" STEAM-PUMP FOR WATER.

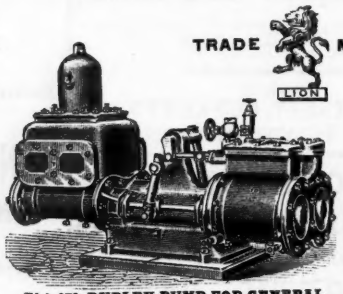

Fig. 670. DUPLEX PUMP FOR GENERAL PURPOSES.

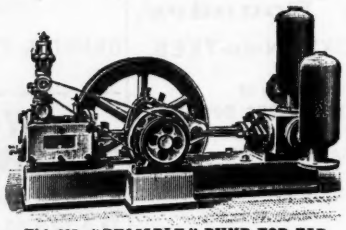

Fig. 685. "RELIABLE" PUMP FOR TAR AND THICK FLUIDS.

Fig. 708. SINGLE RAM PUMP FOR BOILER FEEDING, &c.

JOSEPH EVANS & SONS, Hydraulic Engineers,

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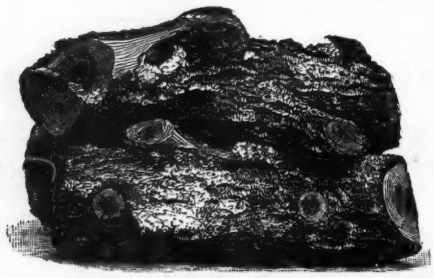
GAS-FIRES.



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Two Sizes—viz., 14 in. and 16 in. long.

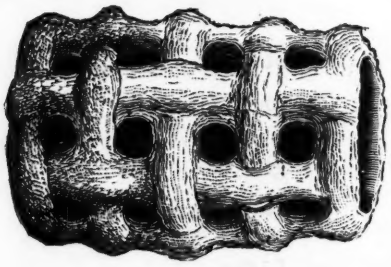
These **GAS-FIRES** are made in one piece, and of Fire-Clay, and have the exact resemblance of **Genuine Logs of Wood.**

They have perforated holes, and when lighted have the remarkably striking appearance of

BURNING LOGS OF WOOD.

They are easily fixed, simply requiring to be connected to an ordinary gas-pipe, or by means of a flexible tube enabling them to be placed in the grate or on tiles.

They fit almost any grate, and have a remarkably **cheerful appearance**, calling to mind the old-fashioned Log-Wood Fires of our forefathers.



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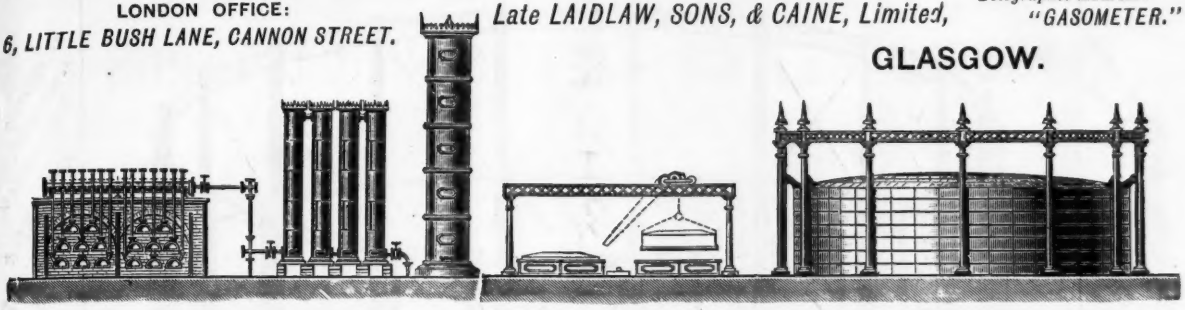

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MAKERS OF THE MOST IMPROVED FORM OF
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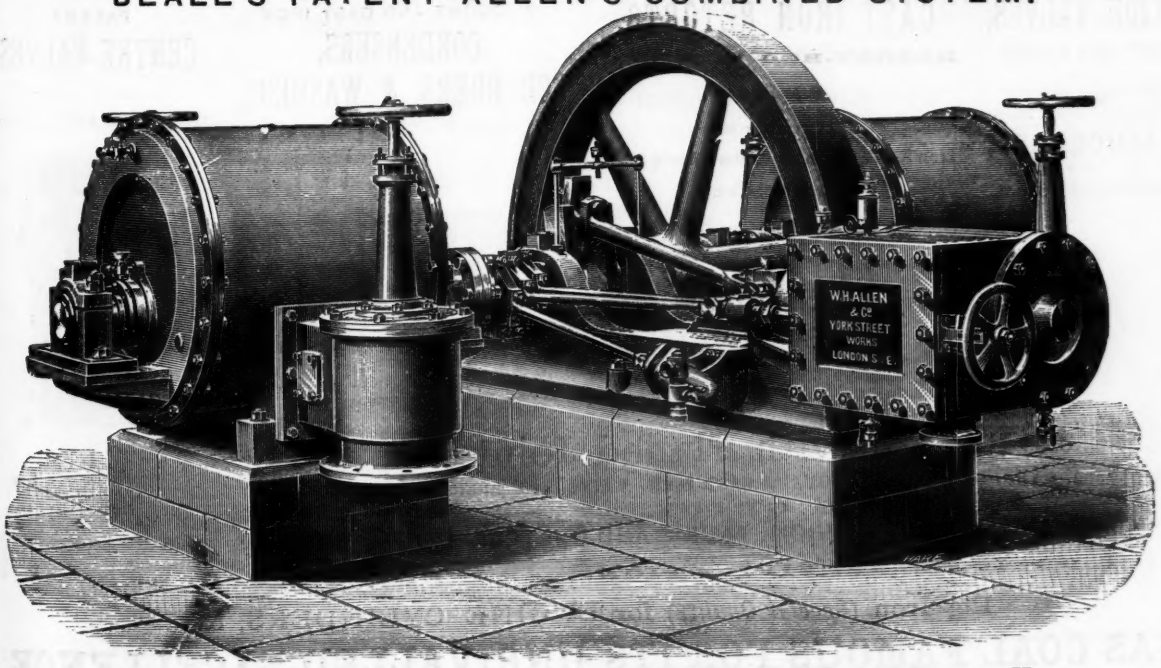

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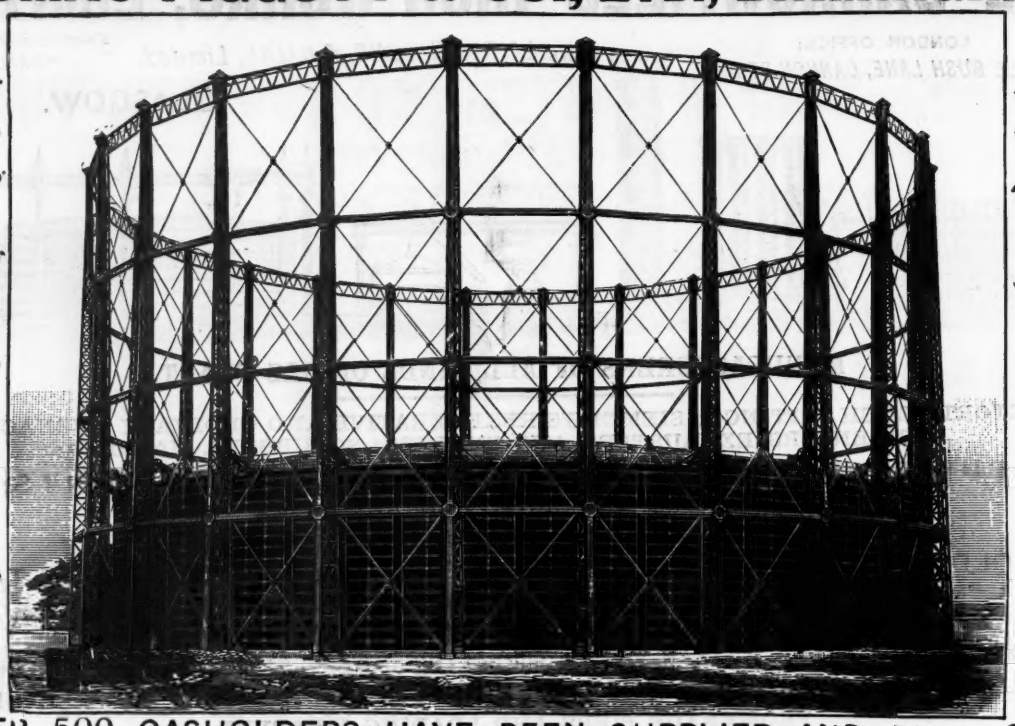

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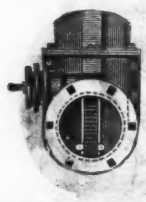

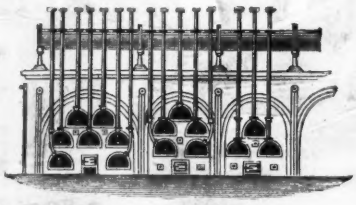

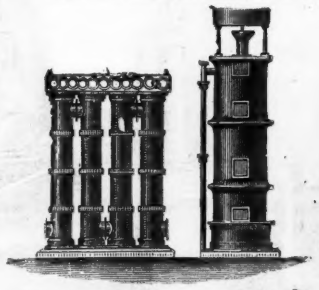

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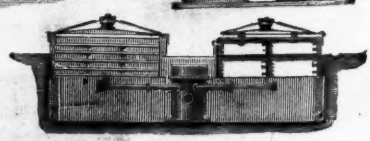

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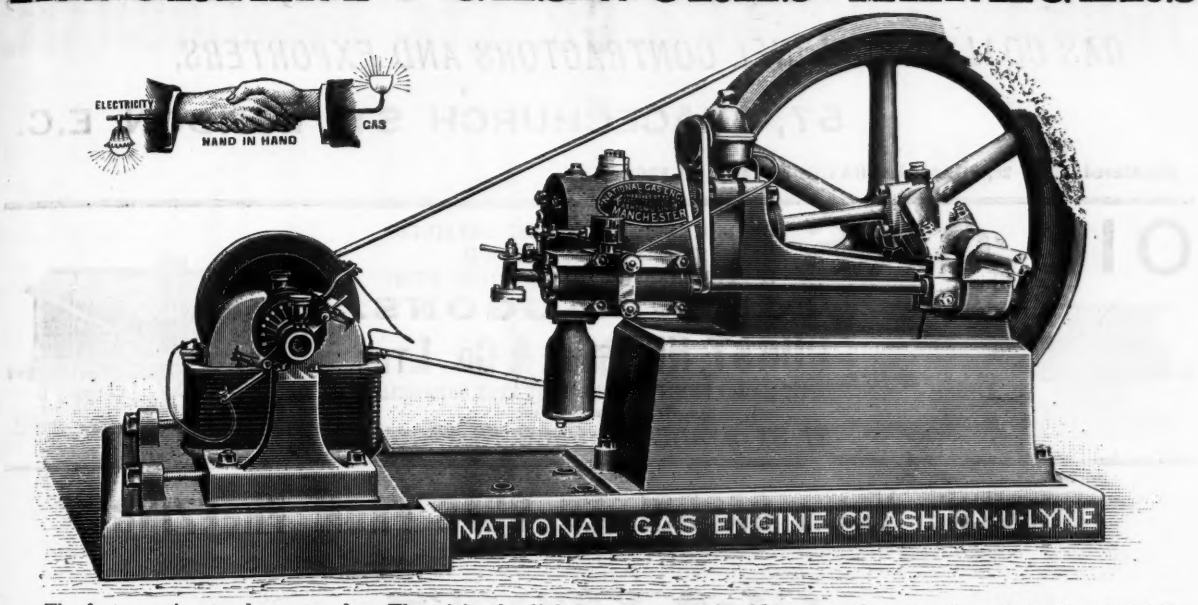

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By the aid of the Gas-Engine driving the Dynamo, **50 PER CENT. MORE LIGHT CAN BE OBTAINED FROM THE SAME GAS**; and thus, by their adoption as the motive power, the gas consumption of the district can be maintained and the light increased.

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As follows:—

Wet Meters in Cast-Iron and Tin-Plate Cases, and Dry Meters in Tin-Plate Cases, fitted with our

New and Improved Patent Attachment,

giving a definite quantity of Gas per Penny. This Attachment will be found **STRONG** and **SIMPLE**; and the Selling Price of Gas can readily be altered *in situ*.

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PREVENT YOUR GASHOLDER CUPS FROM FREEZING

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What is the Continuous?

IT IS A PREPAYMENT ATTACHMENT

THAT IS

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THE MONEY IN THE BOX IS ALWAYS EXACTLY CORRECT WITH THE AMOUNT OF GAS CONSUMED.

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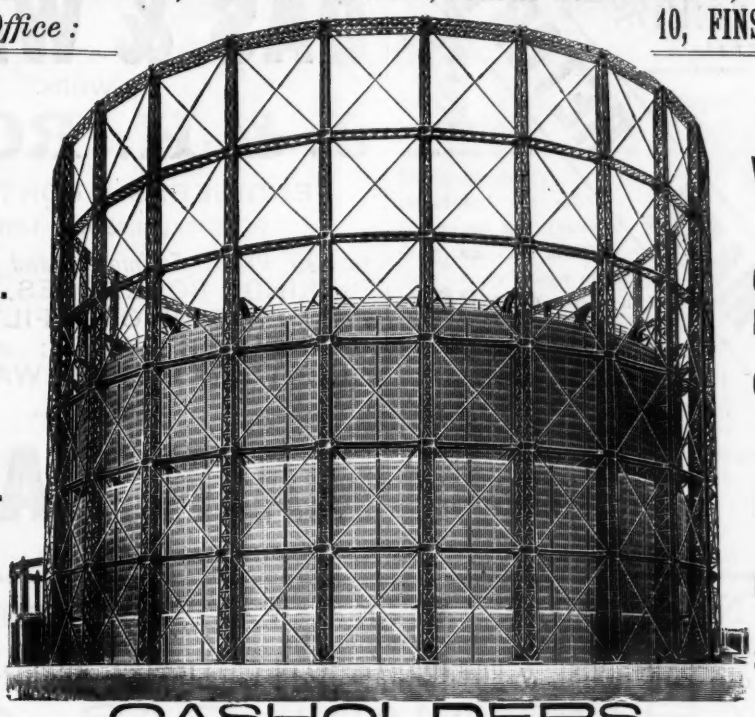

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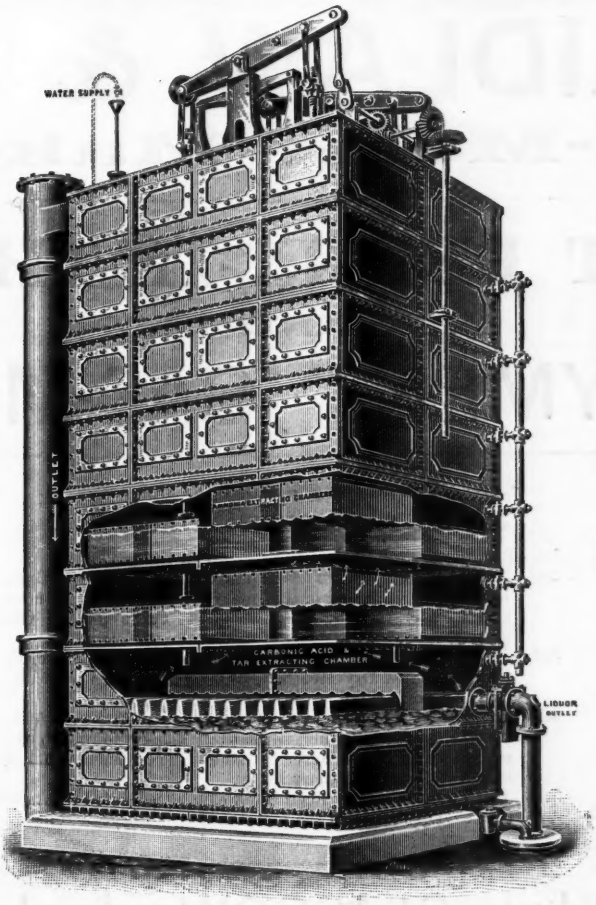
REMOVES ALL TAR & AMMONIA.

And from 40 to 50 per cent. of the Carbonic Acid and Sulphuretted Hydrogen.



REMOVES ALL TAR & AMMONIA.

And from 40 to 50 per cent. of the Carbonic Acid and Sulphuretted Hydrogen.

REMOVES ALL TAR & AMMONIA.

REMOVES ALL TAR & AMMONIA.

Taking the Whole of the Purification between the Condensers and Purifiers.

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ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
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WET AND DRY

PREPAYMENT GAS-METERS

WET METER.

Advantages claimed for our

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1st—It is the most compact arrangement in the market.
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3rd—The whole attachment can be easily adapted to the ordinary Wet and Dry Meters, without interfering with any existing parts.
4th—The Patent Circular Feed Rack gives a POSITIVE quantity of Gas for each Penny, so that the money found in the cash-box will always agree with the value of Gas consumed, as shown by the ordinary index.
5th—The Patent Circular Feed Rack can be adjusted *in situ* to suit changes made in the price of Gas.

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THEY ARE SUITABLE FOR GAS OF EVERY CANDLE POWER,

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THE "BRAY" REFLECTING LIGHT

Is an unequalled combination of SIMPLICITY, CHEAPNESS, and EFFICIENCY.

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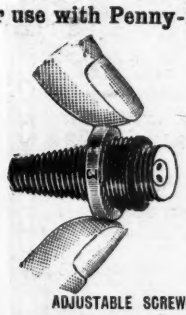
Specially adapted for use with Penny-in-the-Slot Meters, for which purpose large quantities have been sold.



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PATENT "STANDARD" WASHER-SCRUBBER

☛ **484** of these Machines (capable of dealing with **464,490,000** cubic feet of Gas daily) in use which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.

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Every Description of Gas Apparatus.

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ALSO ALL KINDS OF

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AND STEEL WORK,

BRIDGES

ROOFS,

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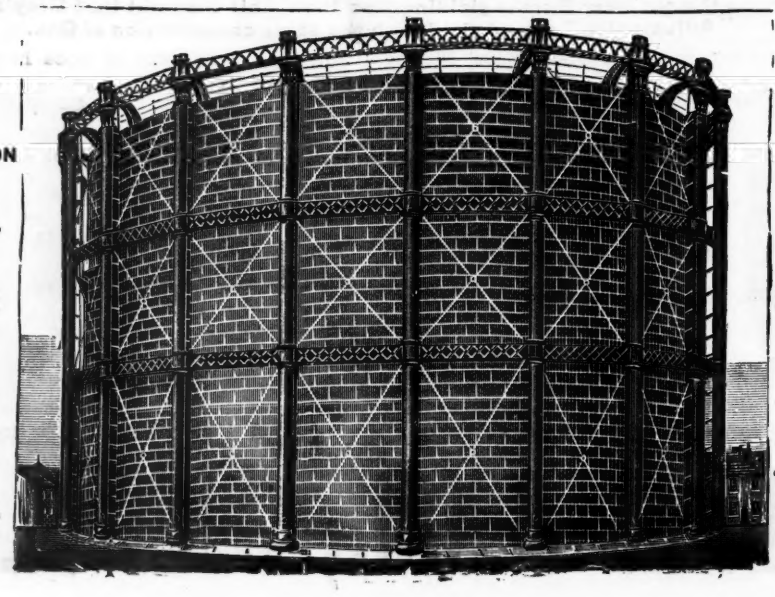

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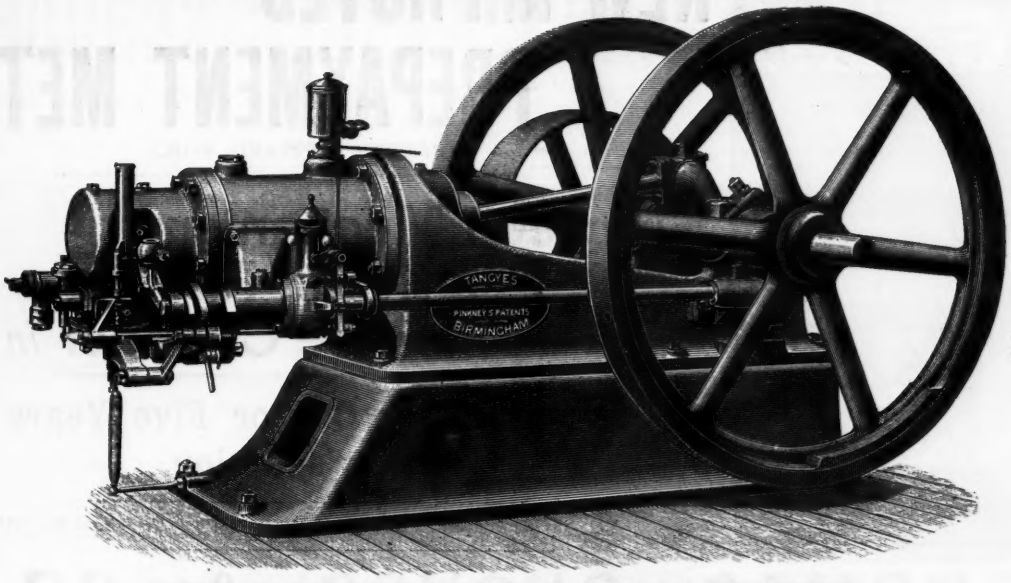

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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE
Birmingham Gas Affairs . . . 1109
The Parliamentary Standard Candle in Court . . . 1110
Mr. George Livesey and Traders' Combinations . . . 1110
The Trade of Rotherham and the Trade Unionists . . . 1110
The Working of the Parish Councils Act . . . 1111

ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 1111
Electric Lighting Memoranda . . . 1111
An Experimental Gas-Works . . . 1112
A New Platinum Standard of Light . . . 1113

NOTES:—
A Rich Fuel-Gas Plant . . . 1115
Electric Arc Lamps and Carbons . . . 1115
A Large and Economical Gas-Power Plant . . . 1115
A Smoke-Bleaching Device . . . 1115

TECHNICAL RECORD:—
American Gaslight Association—The Annual Meeting in Washington . . 1116
The Colour of the Incandescent Gas-Light . . . 1117

REGISTER OF PATENTS:—
Water-Meters—Bel, J. E. A. . . . 1117
Centre Valves for Gas Purifiers—Sisson, W., and Holt, R. . . . 1117
Gas-Lamp for Railway Carriages—Imray, H. (Picard, E.) . . . 1118
Indicating the Time during which Gas has been Consumed—Curtis, F. G. S. 1118
Lamps for Overhead Lighting—Thomas, T. C. J. . . . 1118
Distributing and Igniting Devices for Gas and Petroleum Engines—Lake, H. H. (Krupp, F.) . . . 1119
Manufacture of Combustible Gas—Imray, O. (La Société Anonyme des Moters Themmique Gardie) . . . 1119
Furnaces for Burning Fuel to Obtain Smokeless Combustion—Fell, J. C. (Armstrong, M. M.) . . . 1119
Gas or Oil Heating or Cooking Stove—Stonely, A. J. and A. A. . . . 1119
Gas-Engines—Vermersch, A. . . . 1119
Vapour or Gas Motor Engine—Bryant, C. H. . . . 1120
Gas-Cocks—Handel, T. . . . 1120
Gas Motors—Schimming, G. . . . 1120
Combined Coal and Gas Cooking Range—Stecke, A. . . . 1120
Gas-Burners and Globe Supports—Bray, G. . . . 1120
Gas-Lamps—Cowan, T. W. . . . 1120
Combustion of Gases—Bremme, F. . . . 1120
Gasholders—Dempster, J. . . . 1121
Strengthing Incandescent Gas-Light Mantles—Blucher, H. . . . 1121
Atmospheric Gas Burners—Fletcher, T., and Russell, W. . . . 1121
Patent Notices . . . 1121

CORRESPONDENCE:—
Combinations of Traders in Gas-Works Materials . . . 1122
The Extension of Stoking Machinery at the Birmingham Gas-Works . . 1122
Unaccounted-for Gas . . . 1122
Gas-Fires for Bedrooms . . . 1123
The Meter System *v.* Inspection for Detecting Waste of Water . . . 1123

LEGAL INTELLIGENCE:—
High Court of Justice—Queen's Bench Division—The Commercial Gas Company *v.* The London County Council and Williamson . . . 1123
A Dispute as to a Water Supply for Trade Purposes at Sevenoaks . . . 1124

MISCELLANEOUS:—
Birmingham Corporation Gas Supply—The Reduction in Price; The Committee's Report; Cost of the Change in the Conditions of Employment at the Works . . . 1124
Rotherham Corporation Gas Supply—Results of the Working of the Department . . . 1125
Newcastle-under-Lyme Gas-Works—Reflections on the Management . . 1125
Johannesburg Lighting Company, Limited . . . 1126
Electric Lighting Notes . . . 1126
Stockton and Middlesbrough Water Board—The New Supply Available . 1127
The Works of the Colne Valley Water Company . . . 1127
The Sand Filtration of Water at Lawrence (Mass.) . . . 1127
Notes from Scotland . . . 1129
Current Sales of Gas Products . . . 1130
Coal Trade Reports . . . 1130
Gas and Water Companies' Stock and Share List . . . 1132

PARAGRAPHS.—Mr. E. Willis, 1114—Burnley Water-Works Department, 1114—The Managership of the Ystrad Gas and Water Works, 1114—Institution of Civil Engineers, 1114—Honorarium to Mr. E. A. Loam, 1114—The Representation of the London County Council on the Thames Conservancy Board, 1114—London Water Companies' Dividends, 1114—A New Form of Siemens Furnace, 1115—The Viscosity of Tar, 1115—"Electric Motive Power," 1115—Royal Society, 1115—Another Gas-Enriching Material, 1117—Morley Water-Works Extensions, 1131—Gas-Meter Rents at Nottingham, 1124—Fatal Gas Explosion at West Bromwich, 1125—Proposed Improvement of the Portrush Water-Works, 1126—Sales of Shares, 1129—Bursting of a Water-Main in Durham, 1129—Gas and Electric Lighting at Lancaster, 1129—Opposition to the Mid-Kent Water Company's Scheme, 1130—Reduction in the Price of Gas at Oldbury, 1131—The West Bromwich Corporation and the Incandescent Gas-Light, 1131—A "Record" Day's Consumption of Gas at Belfast, 1131—The Lighting of Pretoria, 1131—Reduction in the Price of Gas at Batley, 1131—The Plymouth Corporation and the Gas Company, 1131—Mr. Alfred Lass on the London Water Supply, 1131—The Whitby Local Board and the Gas and Water Works, 1131—The Gravesend Corporation and the Water-Works, 1131—The Burnley Corporation and the Penny-in-the-Slot System, 1131—Gas and Water Affairs at Owestry, 1131—The Public Lighting of Dover, 1131—The Supply of Water for Baths in Manchester, 1131—The Liverpool Corporation and the Gas Company, 1132—Johannesburg Water-Works, &c., Company, 1132.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 11, 1894.

Birmingham Gas Affairs.

At last Tuesday's meeting of the Birmingham City Council, Alderman Pollack had a grateful part to play; and his speech, in moving the adoption of the report of the Gas Committee, as reported in another column, appears to have given pretty general satisfaction both in and out of the Council. It is not very often that the gas department of a corporation take anything off the price of gas; and though the reduction of 3d. per 1000 cubic feet announced by the Chairman of the Birmingham Corporation Gas Committee is simply a return to prices ruling before the business arrangements of the Committee were upset by the great coal strike, it is something to their credit that they withstood what must have been a pressing temptation to rest upon the accomplished fact, or at any rate to wait until they had a little more money in hand before relinquishing their advantage. Still, the local public do not overlook the point that the whole of the gas consumed in the district up to next quarter-day, being half-way through the period of heaviest consumption, will be charged for at the advanced rates. One discontented consumer there is in Birmingham, if not more; and he has written to a local newspaper to complain that, notwithstanding the present reduction, the price of gas in the Midland capital is double what it ought to be—that is, in comparison with the prices now charged in Liverpool or Manchester. This is, of course, arrant nonsense; and it is difficult to help people who give away what might be a fair case by complicating it with monstrous exaggerations and misconceptions. The discontented one has a perfect right to complain, as he does, that the Gas Committee, by devoting their surplus profits to the Improvement Committee, benefit a number of residents who "never contribute "one farthing to such improvements, for the cogent reason "that they never consume one cubic foot of corporate "gas." The suggestion is made—and very probably not for the first time—that if the Birmingham Gas Department would help the artizan class in the matter of fittings, as is done elsewhere, and make a sweeping reduction in price, gas would become more popular. Alderman Pollack declared before the Council that the department is disposed to give the prepayment meter system a fair trial—a declaration which may or may not cover all that is really essential in the suggestion in question. We take it that the Gas Committee are really in earnest in endeavouring to meet the requirements of the smaller order of consumers, since the Chairman talks of an arrangement whereby in the outlying districts the branch post offices are to be made agents of the Committee for the collection of accounts. This is something like the plan devised by Mr. Henry Green, at Preston, for working his own particular variety of prepayment gas delivery. It is quite certain, however, that no kind of meter alone, nor account-collecting agency alone, will suffice to carry gas where it has not gone before. The provision of fittings is an essential part of every successful scheme for popularizing gas; but there is no mention of any such facility in Alderman Pollack's speech.

It is to be noticed that, in speaking of the price of gas, Alderman Pollack followed the highly illusory comparative method, which was so mercilessly exposed in Mr. George Livesey's article in the "Liberty Review Yearly," to which we have already referred. Alderman Pollack surveyed, for the instruction and comfort of his audience, a select number of instances of other towns where the price of gas is higher than it is in Birmingham. This exercise in comparative statistics seems to have satisfied the Editor of the leading Birmingham newspaper, which repeats the sense of it in these words: "Out of twenty-one large towns, the gas "charges have been reduced in seventeen. But only the "second advances have been taken off; thus leaving the "charge in such cases higher than that in Birmingham. "That is a satisfactory statement." It is a plausible and a familiar one; but is it not a touching display of confidence in official statistics, when such comparisons are allowed to stand for argument? This is what Mr. Livesey says about it, speaking of the ordinary run of municipal gas committees who subsidize the rates: "They compare "prices with a neighbouring municipality, who, in their "turn, make a similar comparison; with the result that "both charge about the same price." The illusion is so artless, that one would wonder at its invariable success, did not common experience testify to the perennial charms of only another order of "confidence trick." Of course, Alderman Pollack and his colleagues are not aware of the fallacious nature of these comparisons, and are above choosing their examples with intent to impose upon their public; but, all the same, they are apt to forget places where the gas is cheaper than their own. Why should Birmingham rest content to excuse itself with reference

to the example of other towns? It is not of the smallest actual moment to a Birmingham manufacturer or shopkeeper what people in Manchester or anywhere else have to pay for their gas. What he wants is to get his own as cheaply as possible; and this he cannot do while the gas bills are made the means of levying an indirect tax upon him. It is not that the tax in Birmingham is very heavy—again in comparison with some places. It is only about 1½d. per 1000 cubic feet, or about the equivalent for a meter charge, which, as Alderman Pollack proudly claims, is not levied in Birmingham. If you go to certain places which shall be nameless, you dare not allude to the comparative leniency of the Corporation of Birmingham in this respect without incurring the displeasure of the local authorities. We only mention this to clinch our argument that as, in matters of gas supply, the municipal idea is that "comparisons are odious" when unfavourable, they are worse than useless as a means of showing when gas is "cheap enough," inasmuch as they put people off the only proper course to obtaining gas as cheaply as possible.

The Parliamentary Standard Candle in Court.

In another column will be found a report of the interesting proceedings of Monday last week before Justices Grantham and Lawrance, when the Commercial Gas Company challenged a certain report of the Chief Gas Examiner on the ground of its having been made without jurisdiction. It was a question of candles. In consequence of circumstances which those of our readers who are conversant with photometrical matters will remember, the Metropolitan Gas Referees were called upon to "prescribe" the candles to be used for testing gas. Just a twelvemonth ago the Referees did so, in an elaborate specification which was reproduced in the Journal; but the Company were unable to procure candles made in accordance with it. This being the state of affairs in April last, the examiner at the Wellclose Square testing-station made a test of the Commercial Company's gas with some old candles, which, the Company aver, they understood to be unsuitable for the purpose. Having used these candles, the examiner reported a deficiency of illuminating power, against which the Company appealed to the Chief Gas Examiner. Another bad report was forthcoming in May, with respect to the gas tested at the Parnell Road station; and again the Company appealed. Both these appeals were decided against them. But the Company declined to enter into the merits of the matter, and informed Dr. Williamson of their intention to raise the question of legality of the tests, on account of their having been made with candles which were not "candles" within the meaning of the Act, since they were not prescribed by the Gas Referees. Counsel for the Company told the Court that the Referees' candle specification had proved unworkable, and was withdrawn last June; but this is the first announcement to the effect that has been publicly made. There is a marked difference, it is true, between the references to the candles in the two last "Notifications" of the Referees; that now in force offering to examine any candles which may be submitted by the proper authorities, and engaging "for the "present" to certify for use in the testing-places any such candles as are, on examination, found to be satisfactory. The Court were told, however, that the prescription was "done away with," as Mr. Justice Grantham expressed it, last June; and this statement is probably correct. There was also a question as to whether in the Parnell Road case the Company could have procured the legal candles. The Chief Gas Examiner says they could have done so; the Company say they could not, and that Dr. Williamson's assertion was all the result of his listening to the County Council officials behind their back. The Court seemed to think that the whole affair is really due to an incompleteness in the direction in the statute; but this will be looked into when the "rule" the Company obtained is brought into Court again in the regular course.

Meanwhile, it is curious how this application, which served to drag the parliamentary standard candle out of its modest obscurity, and place it in the "fierce light" that proceeds from the London Press, also caused a generally well-informed evening newspaper to stumble. The *Pall Mall Gazette* saw in these proceedings an attempt by a wicked Gas Company to get the better of the virtuous County Council. "The trouble," ran the comment, "is "due to the action of the Council's gas referees (*sic*) in "altering the test, as the new candle does not appear to be "trustworthy, and the result is that the Companies seem "disposed to make the best of the referee's (*sic* again) "mistake." The writer goes on to say that "formerly a "test candle of much exactness was procurable; and "it can still be supplied. We are informed, on good "authority, it continues to be used by the provincial cor-"porations." Well, well! one lives and learns. But who is that "good authority?" and where is that "test candle "of much exactness" to be had?

Mr. Livesey and Traders' Combinations.

Once again Mr. George Livesey has succeeded in applying his power and prestige in gas matters in order to procure a benefit for the gas industry generally. His letter on the subject of "Combinations of Traders in Gas-Works "Materials," which appears in our "Correspondence" columns to-day, will be read with much satisfaction by gas managers and engineers. It will be noticed that he now accuses the gasholder builders' "ring" of allowing judgment to go against them by default; and there can be little doubt that his advice will be acted upon to the fullest extent permitted by circumstances, and orders for gasholders be withheld until directors of gas companies and municipal gas committees are reasonably assured that they are not the victims of a scandalous "knock-out" confederation. The members of the "ring" in the implicated trade are bound to give this prospect their early and earnest attention. Nobody wants them to work for nothing, or at a loss; but if Mr. Livesey's information is correct—and until categorically denied it will stand by his authority—certain gasholder builders will be under a most damaging imputation on their business methods. It is with the liveliest gratification, however, that the great majority of our professional readers will learn from Mr. Livesey's letter that his timely action has procured from the meter makers two very substantial concessions. These traders, with a promptitude in discerning where their interest lies which does them infinite credit, profess their willingness to give way in regard to the vexed question of the guarantee. And they are also willing to rob their combination in trading of its chief objection in the eyes of their customers, by making arrangements for an annual revision of the price of meters, with a view to giving buyers the advantage of any cheapening of the cost of manufacture. The news that Mr. Hunt's letter on the contemplated action of the fire-clay goods manufacturers has already done some good is also welcome. And now let us hope that Mr. Livesey's concluding remark will have due effect, and that, combination or no combination, the traders and the gas companies will "get along very well" once more, by reason of the prevalence of fair and honest business principles in the conduct of this side of the gas industry. There is no reason why this should not be so. "Live and let live" is the good old rule which all of us are surely disposed to abide by. It is high time that all the old abuses of the commission system, unfair preferences, "wheel within wheel" dealings, and oppression by "rings," were buried, and only remembered for the warning they are competent to convey. Meanwhile, we desire to put upon record the general sense of gratitude that will be felt throughout the profession to Mr. Livesey for his vigorous initiative in attacking the latest evil product of the trade side of the British gas industry.

The Trade of Rotherham and the Trade Unionists.

Rotherham will be a good place for business firms to go away from, if the tactics of the existing "Labour" politicians who appear to dominate the Town Council are long persisted in. Certain recent dealings of the Corporation Gas Committee with the tenders for stores required for the Department illustrate the position of affairs in this Trade Union ridden locality, especially with respect to the brassfitting and cognate trades. It seems that, in an expansive moment, the Town Council, like many other similar bodies, adopted the now familiar "Fair Contracts Resolution;" engaging themselves to deal only with firms who pay the standard Trade Union rates of wages, and all the rest of it. The bearings of a resolution of this kind, like that of the observations of Captain Cuttle, lie in the applications thereof. In the case of the Rotherham Corporation Committee, these took the form of a stipulation to the effect that contractors whose tenders might be agreed to by the Corporation should accept the dictates of the Corporation as to how their business should be carried on. When the

new conditions came under the notice of the well-known local firm of Messrs. Guest and Chrimes, who had served the Gas Department with meters from time out of mind, they very properly exercised the discretion of which not even Labour tyranny can deprive men of business, and declined to tender. Nothing daunted, the brave leaders of the Gas Committee in the new way passed the firm over, and recommended the purchase of the supplies needed from firms foreign to the town, at prices ranging from 6¾ to 25 per cent. higher than those same goods could be had for in the town. This is the local Progressive notion of local patriotism and general business principles. As soon as the story got wind, however, there was a "breeze" in the Council Chamber. It came out that the whole plot was carried out by four members of the Corporation, and that the decision to obtain the supplies away from the town was made by the casting vote of the Chairman. When the recommendation of this precious Committee was brought forward for confirmation, the Town Clerk was called upon to read Messrs. Guest and Chrimes's letter declining to tender; and a stinging composition it was. So, at any rate, one of the Labour politicians felt it; for he scandalized his companions round the Council-board with a violent harangue which may be understood as addressed mainly to the business firm who had dared to be independent of the Corporation and its resolutions, but which the local paper has judiciously suppressed. In the end, the tenders were referred back for further consideration; and an Alderman has declared that, now the Council know what the Labour party mean by the famous "Fair Contracts Resolution," it would have to be rescinded on the first opportunity. Something will evidently have to be done, unless the sensible men are prepared to see the demagogues ruin the trade of the town in their ignorance and arrogance.

The Working of the Parish Councils Act.

Although the Parish Councils Act has only just come into operation, signs have already appeared which indicate that the trail of slipshod drafting—that besetting weakness of our parliamentary system of law making—is very much over the measure. It seems almost worth while to suggest, for the serious consideration of the Legislature, that, for the future, a means of experimentally running certain new laws should be devised. At any rate, the Parish Councils Act would be all the better if it could be taken back into the parliamentary dock, and refitted in some particulars, after a trial trip. A very curious point has cropped up in East Suffolk, where the County Council Committee on the Act have been exercised with respect to the question of relief from disqualification. One section of the Act provides, very properly, that a person is disqualified from being elected a member of a Parish Council or other governing authority if, among other reasons for disqualification, he is concerned in any bargain or contract with such body. With rare foresight, however, it is also enacted that the County Council may remove this kind of disqualification, if they are of opinion that such removal will be beneficial to the parish. A Debenham ratepayer has asked the East Suffolk County Council to consider the names of three candidates which would in all probability be brought before the Council on the question of disqualification; they being proprietors of the local gas-works, which had served the parish for years, albeit at great loss. The case is particularly hard, inasmuch as the gas-works in question had belonged to a joint-stock Company which had become insolvent, and the three present owners purchased the plant and now carry it on, not only without profit, but actually at a loss. They light the public lamps; and they are consequently formally debarred by the Act from contributing, under the forms provided by the new statute, to the enlightenment of the district in other ways. The case proved too difficult for the Council to decide off-hand. It could not be agreed whether there was any disqualification needing to be removed by them; and the Chairman, with a fine unconscious humour, said "he did not like to exercise "the powers of the Council to remove a disqualification "which does not exist." Wisdom like this is indeed "justified of her children." After sensibly removing the admitted disqualification of certain persons connected with the Halesworth Gas Company, the suggestion was made by an impatient member of the Council that the Debenham case should be finished off. But the Chairman was firm; and the puzzle was ordered to stand over for the next meeting. In the interim, further information was obtained. It transpired that the Debenham gas proprietors had an agreement with the Vestry; and that the Lighting and Watch Act is in force in the parish, so far as lighting is concerned. No sooner was the fact established than the disqualification was removed. There must be a good deal of this kind of disqualification all over the country, which might have been avoided by a few words in the Act itself.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1132.)

All departments of the Stock Exchange were a good deal quieter last week; and the tendency was dull to a marked degree. The crowd of buyers who have been coming in lately have stopped for awhile; and in the more speculative markets, there has been a good bit of profit-snapping. Even the choice gilt-edged lot, after starting the week with a rising tendency, fell back, and remained dull. When the account is concluded next week, things in general will get quieter still, and remain so until they "turn over a new leaf" with the New Year. The Money Market has gone back a little; and rates are decidedly easier. Business in Gas has, in general, been very moderate. On one or two days, it made a little spurt: but it was mostly limited to some particular stock, and soon died away. Prices, on the whole, are firm, though two or three quotations have retrograded fractionally—generally in response to special influences. Gaslight "A" was dealt in to a moderate extent, at good steady figures, never ranging outside 252 to 254. Transtions in secured issues were also restricted. But every issue that was dealt in commanded high figures; and the 6 per cent. debenture stock rose 2 more. It now stands at a 3⅛ per cent. price for money. South Metropolitans were an exception to the general rule of the week, being unusually active. All three issues were very strong; and the top quotations were repeatedly realized. Nothing at all was done in Commercials; and, for lack of business apparently, their quotations remain unchanged. Otherwise, it is not easy to understand why they should figure so much cheaper than other stocks of equal quality. Business in Suburbans and Provincials was at the lowest ebb; and the only feature was a falling of ½ in British. Brentford, however, looked like going higher. All the Continental Companies shared in the prevailing quietude. Union was firm and steady; but Imperial fell away a point. Cagliari rose 1½ on improving prospects. The rest were for the most part devoid of feature; but in the Western world, Buenos Ayres and San Paulo receded to a slight extent. The Water Companies were nearly stagnant all the week, there being very little moving. All stocks, however, were very firm; and Kent and Lambeth have advanced to a slight extent.

The daily operations were: Gas was very quiet at the opening; and only a couple of transactions were marked for the whole day. Gaslight 6 per cent. debenture rose 2; but San Paulo lost ¼. Kent Water gained 1. Tuesday was much brisker; and prices were good. Cagliari rose ½. Wednesday was much the same; and Cagliari advanced 1 more. Business relapsed again into quietude on Thursday. Prices all round were good, except for Imperial Continental, which fell 1. Friday was a shade more active; and almost everything was firm. British, however, receded ½; and Buenos Ayres, ¼. Lambeth Water rose 1. Saturday was very quiet; and all quotations remained unchanged.

ELECTRIC LIGHTING MEMORANDA.

Optimism at Harrow—An Inquiry into the Location of Transformer Chambers—The Comparison of the Cost of Gas and Electric Lighting.

The ratepayers of many towns of the United Kingdom have great reason to complain of the manner in which their representatives have approached the question of electric lighting. Instead of properly investigating the case for and against proposals emanating from interested parties for spending the public funds upon a central station undertaking, in too many instances the Committees to whom the question is referred constitute themselves violent partisans of their electrical advisers, and take no pains whatever to sift the statements laid before them to show that electric lighting schemes are fit subjects for municipal enterprise. The example of the Electric Lighting Committee of the Harrow Local Board is to the point. Here a scheme has been prepared by an electrician whose competence we do not desire to question. The scheme as such may be a very good one; but the Committee are bound to admit that what they call "a considerable amount of misapprehension"—meaning a good deal of opposition to the idea—prevails among the ratepayers, who fear they may be called upon to pay heavily for the luxury of an electric lighting venture; and the first thing they do, in their report to the Local Board after considering the tenders for the proposed

establishment, is to try and convert the local public to a belief in the advantages of the project. The Committee are fain to confess that the opponents of the scheme have a strong point in the fact that the Board "have not adduced examples of places that can be compared with Harrow where electric lighting has been introduced with success;" and the objection appears likely to continue, for all the Board can do to remove it. They have gone to Whitehaven in the north and Hove in the south for evidence to show the profitableness of small central supply stations; but it may well remain an open question how far such examples touch the point at issue. The Board's electrician has also succeeded in persuading the Committee that electricity at 8d. per unit is equivalent to gas at 4s. per 1000 cubic feet; and they say upon this estimate, which has been disputed on behalf of the ratepayers, that it was based on the widely accepted view that electricity at 6d. per unit "is equivalent to gas at 3s. per 1000 cubic feet." It is notorious that authorities like the leading electrical journals accept the rough rule that the price of the unit in pence is equivalent to the price of gas in shillings per 1000 cubic feet; but the whole spirit of the Harrow Committee is absurdly optimistic and confiding, as appears more especially from the fact that they are ready to commit the town to a serious amount of unnecessary extra indebtedness upon an estimate showing a yearly profit of £194 when all the lamps reckoned upon by their electrician shall have been connected up. With the whole history of electric lighting estimates to go upon, if they would only open their eyes as they ought to do in the ratepayers' interest, the infatuation of the Committee is certainly remarkable.

An inquiry is to be held at the Board of Trade on the 13th inst. as to the situation of transformer chambers. These, it will be remembered, are underground cells of considerable dimensions—differing altogether from the small street junction boxes—and are necessary for the latest system of high-tension electrical distribution. There is considerable difficulty in finding room for them where they are most wanted. The London County Council and other local authorities in the Metropolis have objected to their being placed under the roadway or pavement of the public streets, for the reason that they constitute a serious obstruction, and may possibly interfere with the laying of future gas, water, and other pipes, besides being a grave public danger in themselves. The Board of Trade has therefore been urged to make an order compelling electric lighting companies to put their transformer chambers upon private property. On the other hand, the companies affected contend that there is no danger to the public in placing the chambers in the thoroughfares, and that they can be so constructed as not to form any serious obstacle to the future use of the streets for other necessary purposes. The point is of great importance to all parties; and the decision of the Board will be anxiously awaited. For the electric lighting companies to be compelled to make provision privately for these chambers would mean a very considerable unforeseen additional outlay on capital account; but it can hardly be seriously contended that statutory right to use the subsoil of the public streets for laying electrical conduits carries permission to construct unlimited cellarage under the public highways. Moreover, the history of the actual dealings of electric lighting companies with the streets is not of a character to encourage the authorities to stretch their facilities in this regard beyond the strictest necessity. It is a case of "Remember Cannon Street!" for them. The simple fact of the matter is that the fewer cavities there are under the public streets, the better for public safety. It was long before cautious engineers could bring themselves to recognize the advisability of constructing streets with subways for pipes in them, on this very account, notwithstanding the obvious convenience of the arrangement. It is not enough to say that provision can be made for ventilating such cavities; for it is one thing to make the provision, and quite a different matter to make it always work in the way intended. It may be noticed that the *Electrician*, in commenting upon the Cannon Street affair, points the moral that it was a case of hurry on the part of the Electric Lighting Company. "Had there been no need to hurry on the switching in of the Watling Street sub-station, and had fuses of reasonable carrying capacity been provided, the City Company would to-day be many pounds in pocket, and the daily press several sensational columns short." Just so. Again there has been shown to be much virtue in an "if." But the better way to regard this incident of the modern development of electric distribution is to treat it as a warning of what may happen with still more disastrous effect unless the greatest care is exercised in regard to the "trapping" of the public streets.

There is a point in the comparisons that are so unceasingly made between the cost of electric and gas lighting, which should be particularly noted. Professor Fleming is undoubtedly correct in stating that no exact comparisons of the cost of one system of lighting with the other can be made, because there are too many, and too varrying and uncertain, factors to be taken into account on both sides. Approximate comparisons are easy, however, and can be made to differ very widely. Much stress is laid by electricians upon some statements that have emanated from users of incandescent lamps in the flush of their fresh experience, to the effect that they do not find the expense of the new system greater than the old. It is possible to accept the truth of such statements, without drawing from them the mistaken inference that therefore electric lighting is as cheap all round as gas. The user of an expensive luxury, knowing it to be one, may be very careful over it, and so keep his total expenditure in check as even to save money in comparison with what he would have laid out upon a cheap and common article. A navvy may spend as much every week on beer as a gentleman on wine for his own drinking; but this does not prove that the one liquor is no dearer than the other. People who may be interested in systems of lighting will do well to bear this consideration in mind; for it is a common trick of the partisans of electric lighting to impose a general validity upon very small and local testimonials in their own favour.

AN EXPERIMENTAL GAS-WORKS.

THE issue of the new series of the "Proceedings of the Institution of Civil Engineers" for the session 1893-4 received fitting notice in *The Times* for the 30th ult. It is remarked that the weekly meetings of the Institution call forth papers and discussions which range over a very wide field, and which mark step by step the advances made in practical enterprise and concurrent scientific investigation and thought upon engineering subjects. Following upon this compliment, the writer of the article observes: "Could the Institution add to its other functions that of initiating and organizing research in directions where it is most conspicuously needed, in the manner accomplished by many of its imitators and children on the Continent and in America, it would enormously strengthen its claim to leadership in furthering the advancement of the profession. There are many directions in which progress is hindered and enterprise cramped for the want of properly-verified experimental data, and in which experiment is too costly, and the field of investigation too wide, for individual effort to cover." The hope is expressed that when the cost of reconstructing the Institution buildings has been met, such research work may be undertaken on the initiative of the Council of the Institution. This suggestion is supported in a subsequent issue by a letter in which the writer says that all engineers will agree with it; and he points to the good work done in this direction by a kindred society—the Institution of Mechanical Engineers—as evidence that research into engineering problems is not confined to the Continent and America.

It is not for us to discuss this matter here as a question of policy for the ruling authorities of the Institution. It should be supposable that the eminent professional men who constitute the Council of the Institution know best what is good for it; and if the general body of members are of opinion that they get good value for their subscriptions and entrance money, there is no more to be said. We have on several occasions expressed the opinion that the management of the Institution is not so progressive in certain respects as might be wished; but if the members are satisfied, that is a sufficient answer to all criticisms of the kind. The statement made public in the columns of *The Times* with reference to the research work of the "Mechanicals," as this society is familiarly termed, may be regarded as raising the question as to whether the ample funds of the senior Institution are employed as fully and fruitfully as might be desired in the interest of engineering science. Those members of the Institution who are interested in maintaining its credit and extending its usefulness may take this matter up, as a point of policy; but for the present we desire to turn the suggestion of *The Times* to account for the special benefit of gas engineering science.

The action of the "Mechanicals," and indeed the very existence of this society and its congeners, go to prove that, while members of all non-military branches of the profession find some advantage in belonging to the premier engineering Institution, this organization cannot, or will not, fully satisfy all their particular requirements for help in studying their own speciality, whatever it may be. This well-known fact of professional experience compels specialists in engineering to form themselves into departmental societies, where they can procure more frequent opportunities for discussing their own particular kind of "shop." So there are not only separate societies for mechanical engineers, but also others for "electricals," town and county engineers, and the followers of that important branch of the profession which is engaged in the great and growing gas industry. Now, it is a singular fact that, while any group of engineering specialists, taken at a venture, will freely confess to the existence of a need for research into many doubtful points of the theories and practice which are best known to them, anything like combined effort in instituting systematic investigation is extremely rare. The ordinary member of a technical society expects his friend the secretary to do all that is necessary in procuring a sufficiency of papers to entertain him at the society's meetings. The member of council possibly feels a little more responsibility for making the meetings successful; but one and all shirk the duty of organizing investigation into matters of which everybody wants to have a better understanding, yet which may not be of immediate importance to anybody in particular. When a man really does want to know something, or happens to have a difficulty, he has to bustle about to get information himself from any source available to him, which he may or may not eventually make public in the shape of a communication to a scientific society.

Such is the origin of most technical papers, which, in the vast majority of instances, need a good deal of correction for the "personal equation," and are consequently much less valuable than they would be if this unknown quantity were safely negligible. Particularly irritating as well as disappointing is it when the personal element is the preponderating one in technical papers dealing with subjects of real and general interest. For some inscrutable reason, the technical literature which represents the work of professional societies connected with the gas industry seems to be burdened with the personal element in a superlative degree. One might turn over the pages of many volumes of the Transactions of such societies, and find paper after paper devoted ostensibly to the full and impartial setting forth of some system, or process, or apparatus, but in reality meant to present the subject in a particular perspective view. Of course, the evil is not peculiar to societies of gas managers. But it is certainly very commonly met with here; and if the unspoken comments of the members, who know perfectly well what is the "true inwardness" of many papers which they are fain to discuss in conventional terms, could be printed alongside the words actually spoken, the record would often be much livelier reading than it is. We do not refer here to the obvious partialities of inventors and others who read papers upon subjects in which the inclinations of their interest is not concealed; but to those other compositions and speeches, of which the number is immense, wherein the prejudice or partiality of the writer or speaker is more patent than strict regard for science would permit. So we have, in the gas engineering profession, men who believe this, and will not hear of the other thing, to a degree which inspires an observer with the idea that if there is a science of gas making, it cannot claim to be exact.

Of course, men do not cease to be human upon becoming gas engineers; and it is only natural that professional opinion should take sides about debateable points of theory and practice. But when all due allowance is made on this account, there remains in modern gas management far too much uncertainty, chiefly due to sheer ignorance. There can be no doubt that well-directed investigation would remove a great deal of this ignorance, and would tend to the saving of much money that now runs to waste in consequence of it. Some years ago, the Incorporated Gas Institute did something in this way; but, for reasons that need not be gone into here, it is now hopeless to look for assistance to any existing gas managers' society.

Mr. J. W. Helps, the Engineer of the Croydon Gas Company, and the popular Honorary Secretary of the Southern District Association of Gas Managers, once mentioned this subject at a meeting of the Association, and suggested that a small joint-stock company might be formed with the object of acquiring or constructing gas-works for the express purpose of trying experiments in gas-making processes and plant. Strangely enough, the opportunity is now presented, in Mr. Helps's own district, of effecting a realization of his idea upon far more favourable terms than he could possibly have contemplated as possible when he shadowed it forth, upon the occasion referred to. The Carshalton Company's district having become united with that of the Croydon Company, the old Carshalton Gas-Works are no longer required. For the present, the station stands perfectly equipped and serviceable for gas making upon a commercial scale; but, unless otherwise arranged, the Croydon Company must eventually dismantle it, and dispose of the plant for what it will fetch. What is to prevent the formation of a gas company to enter into an engagement with the owners for the use of these works for experimental purposes, except the apathy of those who ought with alacrity to take advantage of the opportunity? The conditions are unique. Here is a well-found little works, a convenient distance from town, complete in every respect, and capable of being connected up with its own network of distributing plant, if the object is to test a system of supply, or of sending the product into the neighbouring Company's holders. The Croydon Company would doubtless arrange to purchase any gas of suitable character for their use, so that the cost of conclusively testing a new process would be reduced to the minimum. If the thing were properly done, the promoters of new departures in gas making would gladly co-operate in having tests made at such a station, where every novelty would have a fair field and no favour. At present, the greatest difficulty is commonly experienced in procuring a proper test of a new gas plant or process in a convenient locality. The engineers of the largest gas companies naturally object to be made use of to dry-nurse every novelty of the kind that comes along; and the smaller men seldom have the conveniences requisite for the conduct of proper experiments. Then, again, a gas manager may take a fancy to a novelty, or he may not, even though he gives it harbour upon his works; and it is doubtful whether enthusiasm for, or antagonism to, any new thing does it most harm in its callow period. So it comes about that the gas industry is at the present moment encumbered with perhaps half-a-dozen processes and appliances which can neither be said to have succeeded nor to have failed, They answer after a fashion in one place, and are useless in another. One manager is confident that a certain practice is right; while his next neighbour avers it to be distinctly wrong. The remedy for all this is an experimental works, where patentees and promoters can do whatsoever they please, by arrangement with the proprietors, and where the results can be certified by independent examiners. Stoking and carbonizing, carburetting and purifying, problems of gas manufacture, storeage, distribution—everything of the kind could be tried at such a place as the Carshalton works, under reliable supervision. The man who knows how to prevent the deposition of naphthalene in inconvenient places could work here; the only infallible cure for stopped ascension-pipes could here be demonstrated—in fact, there is no saying what such a works could not teach to those capable of profiting by the results of experiment. The question is: Can anything be done to make use of the opportunity? Will anybody come forward with a scheme for securing such a boon for the gas industry of the United Kingdom? We will gladly devote our columns to the furtherance of so good a cause, if those of our readers who have the will and the power to impart to it a feasible embodiment will take it in hand.

A NEW PLATINUM STANDARD OF LIGHT.

The search for a perfect and universally acceptable standard of light is still going on in every part of the world where science is cultivated. Several makeshift units of light are meanwhile in common use for such practical work as cannot wait for the universal standard of measurement which is not yet in sight; but nobody pretends to be quite satisfied with any of them. What has actually been done by the foremost European nations in this respect gives fresh point to the well-known tale about how three men of science—English, French, and German—were once set to describe a camel. The Englishman read up the subject in books of travel, and went to look at the real animal in a menagerie. He eventually produced a description of the creature, reliable enough for anybody who wanted to know about it for practical purposes, but unsystematic, confused, and in parts contradictory. The Frenchman looked at a picture of a camel, skimmed an author on natural history who had never been out of France, and produced a charming essay, brilliantly written, apparently full of scientifically arranged information, and utterly useless owing to omission of important matters of fact. The German sat at home, and evolved a camel out of his own inner consciousness. In regard to the question of standards of light, the action of England and France has been exactly upon the lines of this parable. We have several working standards; and there is a Board of Trade Committee of scientific and practical men who are supposed to be engaged in reducing them to order, and settling what to recommend for general use in legal tests of the illuminating power of gas. But the whole subject is sadly confused and greatly lacking in logical treatment. France has a universal standard unit of light, sealed with the approval of several science congresses, and not used by anybody. In order to mend matters, French science divides this non-existent unit by twenty, and calls the result a decimal candle; whereas it is neither a decimal nor a candle, and has no more real existence than the hypothetical original. Here, however, the parallel with the camel essay fails; for the Germans, so far from being content with something evolved from human consciousness, have produced the handiest and most practical standard of light in existence. Yet the amyl-acetate lamp is little used, if at all, by other than German hands.

The possibility of making a reliable standard of light by the aid of platinum has long tantalized physicists, who have reason on their side for condemning all standards depending upon the operation of a wick, and for entertaining grave suspicions as to the reliability of any standard involving combustion. Recently two German investigators—Herr O. Lummer and Herr F. Kurlbaum—have once more taken up the study of platinum with this object; and they have communicated their views to the *Electrotechnische Zeitschrift*. They admit that there can be no question of an absolute unit of light, referable to physical quantities, because it is a physiological effect. At the same time, it is argued that we may conveniently deal with a technical or working unit and a physical unit of light. But the distinction only means that the former should be something that is above everything convenient, cheap, and easily produced; its accuracy being a question of more secondary importance, and determined by the character of the work to be done by it. A physical unit may be taken to mean something that is beyond all things accurate; its capacity for easy reproduction being a secondary consideration. Of all the proposed working standards of light of which the German Technical Institute—the Reichsanstalt—has cognizance, only the Hefner-Alteneck lamp is regarded as fulfilling all the requirements of a practical light-unit; and the Institute has for some time past undertaken to standardize it.

This standardization, however, necessarily presupposes an accurate physical standard of reference; for which purpose the Reichsanstalt officials have had nothing better than a series of incandescent electric lamps (which had been compared among themselves) supplied by a current capable of regulation to 0·01 per cent. This expedient is, however, unsatisfactory; and to replace it by a definite and reproducible unit of light has long been the most important optical problem at the Reichsanstalt. First, the authorities paid the Violle platinum standard the compliment of reproducing it, both according to the author's method and later by electrical heating. The experiments showed that the results were affected both by the purity of the

platinum and the nature of its surface; and the unit was therefore provisionally abandoned. The Siemens platinum unit was also found inaccurate—to the extent of 10 per cent. or more—in some hundreds of experiments. These experiments, however, indicated that absolutely pure platinum is a very suitable material for displaying an incandescent surface. But it was also shown, on the other hand, that neither the melting nor the solidifying point of platinum could be taken as the datum temperature without considering the conditions. Hence a new method of attaining and preserving a constant temperature had to be sought, since it seemed a fair inference that the light radiation from a surface at a given temperature would always be the same.

Several devices to produce a constant platinum unit were tried. One was successful; although, as might have been expected, it did not turn out to be at all an easy thing to do—requiring, indeed, a complicated and delicate apparatus and skilful manipulation. With respect to accuracy, however, the authors show that it can be sufficiently well reproduced; several standard apparatuses having been constructed, all agreeing with each other within 1 per cent.

The definition proposed for the new unit is the light emitted by a surface of 1 square centimetre of platinum at a certain temperature defined by the ratio of two quantities of heat radiation—one being the total radiation emitted by the platinum; the other being that proportion which passes through a certain absorbing medium. If, for example, these quantities have the ratio 10 : 1, the temperature of the platinum may be thus expressed. These quantities are to be measured by a rise of temperature manifested by a bolometer placed in their path. The absorbing medium is defined as a quartz vessel, with parallel sides of given thickness, enclosing a volume of water also of given thickness. Means are employed to keep up the temperature of the platinum, which need not be stated in thermometric degrees, as it is assumed and found that at the same temperature the platinum will always emit the same amount of light.

In the apparatus constructed upon these principles, a piece of sheet platinum is rendered incandescent by electric current, and has in front of it a diaphragm with an aperture 1 square centimetre in area. The rays passing through this hole strike upon a bolometer—first with the whole radiation, and, secondly, after interposing the absorption vessel. The ratio of these two radiations is shown by the galvanometer deflections. The current which heats the platinum is varied until the two radiations have the ratio of 10 : 1; and when this ratio is established, the light emitted by the platinum through the hole in the diaphragm is considered as the standard unit of light. The platinum strips used are about 25 mm. wide, 60 mm. long, and 0·015 millimetre thick; and they are set up with their length horizontal. The current required is from 50 to 80 ampères at 32 volts, passing through an ammeter and regulating resistances. The strip of platinum is surrounded by a circulating water-jacket; and the diaphragm has to be protected in the same way. The absorption vessel has quartz sides, 1 millimetre thick; and the layer of water is 2 centimetres through.

It is of capital importance in judging an arrangement of this character, to recognize the possible sources of error, and their value. There is a complexity of apparatus here, adjusted to give an extremely sensitive result; and the physical sources of error are many—to say nothing of the observation errors. The water-jacket is stated to be very efficient in maintaining the constancy of heat of the platinum, so far as this has to be assured by external shielding. It was found that an alteration of 1 per cent. of the galvanometer deflection meant a difference of 3 per cent. in the light; and this deflection can be determined by a series of observations to 0·7 per cent. The extent to which the standard may vary through this cause is, therefore, about 0·3 per cent. As to the surface of the platinum, which volatilizes in use, it is stated that the chemically pure metal becomes as smooth as a mirror, and gives errors not exceeding 0·5 per cent. The size of the hole in the diaphragm must be accurately known; but an error of about 0·2 per cent. is likely to arise with the most careful measurements. The preparation of the absorption vessel must also, it need scarcely be said, be exact. The bolometer has to be carefully calibrated.

After these preliminary experiments at the Reichsanstalt, it is considered that the reproduction of such a standard of light as the one in question—the apparatus having been once constructed—is fairly simple; and its accuracy to 1 per cent. appears assured. It is, at all events, intended to use this unit for the future at the Reichsanstalt for standardizing work. The value assigned to the new unit is not stated with reference to the Hefner-Alteneck or other familiar quantity of light. The proposers of the new unit have been sharply criticized by Herr von Hefner-Alteneck, who, entirely undismayed by the name of the Reichsanstalt, strongly objects to the distinction set up between what are called "working" and "physical" standards, if it is sought to show thereby that his lamp is not just as "physical" as the new platinum device. If the term "physical" here means simply "accurate," then it is to be supposed that the Violle and Siemens standards must be classed as "unphysical," because they are so very inaccurate. But the Lummer and Kurlbaum unit rests on the same basis, and is neither better nor worse for the description given of it by its proposers. Herr von Hefner-Alteneck claims emphatically that the standard of light which bears his name is in no need of standardizing by the pedantic methods of the Reichsanstalt—being simplicity and accuracy itself, so far as the construction of the lamp and the constancy of the combustible are concerned. If one lamp differed in lighting effect from another burning the same fuel, then it would be necessary to refer both to a common datum; but it is the essence of the case for the amyl-acetate lamp that this discrepancy does not occur. The accuracy of the lamp standard in question is only limited by a liability of the flame to differ in height, and to be otherwise affected by atmospheric influences which have not yet been fully investigated, but which apply to every flame burning in air. It may be expected that these difficulties will be removable, or the value of the disturbances determined, so that no practical objection shall remain on this score. But in any case it is no good to compare lamps with a unit unaffected by such atmospheric conditions; and one cannot supply standardized air in which to burn the lamps.

Herr von Hefner-Alteneck carries the controversy into the enemy's country by roundly declaring that since 1884, when the Violle unit was nominally adopted as the international unit of light, it has been seen of none; and its adoption was not only a complete failure, but the blunder has stood in the way of a better agreement on the subject. However, as proposals are constantly being made for comparing standards of comparison used in photometry with a unit of light, Herr von Hefner-Alteneck states that such a comparison, even with a perfect standard of light, would be quite superfluous and useless. He argues that the search for a unit in photometry can only be of use if it is directed to the distribution to the widest possible extent of a source of light capable of actual use in making measurements, as a unit of light in itself. It is conceivable, Herr von Hefner-Alteneck remarks, that physical problems may crop up demanding the highest possible degree of accuracy in light-measurements, so that considerably increased trouble and cost should be of little importance. Then the new platinum unit may be used with advantage—being a certain standard, and a step in advance in photometry. But such cases may be left to be dealt with by themselves; they are altogether apart from the wide outer field of physical and technical photometry to which the amyl-acetate standard is so well adapted, according to German opinion—though why opinions should vary with nationality on such a subject is hard to understand.

Mr. E. Willis, has been elected a Director of the Rochester, Chatham, and Strood Gas Company, in succession to Mr. J. Levy, deceased.

Burnley Water-Works Department.—The salary of Mr. W. Williamson, the Water Engineer of the Burnley Corporation, has been advanced by £25 per annum; and a rearrangement of the staff, with increased wages, dispenses with the position of Assistant-Manager, and a consequent saving in wages.

The Managership of the Ystrad Gas and Water Works.—Mr. A. R. Cawley, who for the last four years has had the management of the Darwen Corporation Water-Works, has been appointed General Manager to the Ystrad Gas and Water Company. Mr. Cawley was previously for a number of years at the gas and water works of the Oldham Corporation.

Institution of Civil Engineers.—At the monthly ballot for membership of the Institution last Tuesday, Mr. W. R. Chester, of Nottingham, was elected a member. On the same occasion, the following were admitted as associate members: Mr. L. G. Hall, Manager of the Rhyl Gas-Works; Mr. H. S. Hart, of the Shanghai Water-Works; and Mr. J. S. Millington, of the Marlborough Water-Works.

Honorarium to Mr. E. A. Loam.—The Corporation of Stalybridge have unanimously confirmed a resolution passed by the Gas Committee, and presented their Gas Engineer (Mr. E. A. Loam) with the sum of £100, as an honorarium for special services rendered in connection with the construction of the new tank and holder at the Flatts, the carrying out of which has been attended with many difficulties owing to the nature of the ground.

The Representation of the London County Council on the Thames Conservancy Board.—At the meeting of the London County Council last Tuesday, six members were elected to serve on the Thames Conservancy Board, as representing the Council, under the provisions of the Act of last session. Mr. C. Harrison and Major Sheffield will serve for one year; Mr. Arter and Mr. Bassett Hopkins, for two years; and Mr. M'Dougall and Mr. Steadman, for three years. The duties will commence on the 1st prox.

London Water Companies' Dividends.—At their forthcoming half-yearly meeting, the Directors of the Grand Junction Water Company will recommend dividends for the last financial half year at the rates of 8½ per cent. per annum on the ordinary capital, 7½ per cent. on the £25 "C" shares, and 7 per cent. on the £50 "D" shares. The Directors of the Southwark and Vauxhall Water Company, in their report to the shareholders, recommend a half-year's dividend at the rate 5 per cent. per annum on the preference stock, and of 6 per cent. per annum on the ordinary stock and class "D" shares.

NOTES.

A Rich Fuel-Gas Plant.

A report of the Committee on Science and the Arts of the Franklin Institute has been published in the *Journal* of the Institute, upon a system of producing fuel gas and its application in the generation of heat for mechanical work, introduced by the American Gas Furnace Company, under the patents of Mr. E. P. Reichelm. The special features of the system are stated to consist in the production of a rich fuel gas in quantities determined in each case by the demand, to be consumed immediately in the furnaces as rapidly as it is generated, without employing storeage reservoirs; and in the simple and practical means employed for ensuring the control of the proportions of the mixture of air and gas, and of the rate of combustion, by the regulation of the air pressure. This gaseous fuel is made from naphtha, described as the cheapest product of the petroleum refinery, by an improved method of atomizing the liquid, which ensures the complete vaporization of all the fluid supplied for the purpose. The naphtha delivered to the atomizing apparatus is displaced by water in the storeage-tank situated below the lowest level of the remainder of the plant, so that no air space is permitted to exist in which explosive gaseous mixtures could form, and no flooding of any part of the plant by accidental injury or leakage is possible. The inventor claims to have learned by experience that, to obtain an exact mixture of air and fuel in any desired proportions, it is necessary that such mixture should be made previously to, and not at or near to its arrival at the point of combustion. Although the gas-generating plant and certain applications of the fuel are illustrated with the report, no quantitative results are given. The system is chiefly noteworthy as evidence that producer gas is not regarded by American engineers as the sole resource of modern science for replacing natural or coal gas as fuel for industrial purposes.

Electric Arc Lamps and Carbons.

Improvement of electric arc lighting has been attempted in France by the employment of so-called "holophane" lanterns, in which the glass is made with vertical corrugations on the inside surface, and horizontal corrugations on the outside, formed by pressing the glass. The internal corrugations are all similar; but those outside are so proportioned and disposed as to throw a uniform light upon all points in a horizontal plane below the level of the lantern. The loss of light by absorption with properly-designed corrugations does not, it is reported, exceed 9 to 13 per cent.; while the same means produces a slight iridescent effect which is thought to impart a peculiarly rich appearance to the light.* While upon this subject, it may be noted that, according to tests made in the Armour Institute laboratory, the modern proposal of rating the power of arc lamps by the current consumed, instead of by a nominal candle power which is always more or less exaggerated, leaves too much to the quality of the carbons. It is complained that the quality of the carbons now in the market has not been improved with the lamps in which they are used, and that a difference of illuminating power of 30 per cent. may be found between two samples. The best carbons gave with a current of 10 ampères an average horizontal illuminating power of 454 candles; whereas the worst of nine samples experimented with gave only 316-candle power, though taking very slightly less current.

A Large and Economical Gas-Power Plant.

Messrs. Matter and Co., of Rouen, are making good progress in the construction of large "Simplex" gas-engines under the patents of Messrs. Delamare-Debouteville and Malandin. For a flour-mill near Paris, these makers have built a single-cylinder engine of this type capable of indicating 450-horse power with town gas. Producer gas is, however, used; and with this, 320 indicated horse power has been developed. As the engine has to run continuously, day and night, great care has been required in all the fittings and arrangements. The gas is produced by means of two generators of the Buire-Lencauchez type, also constructed by Messrs. Matter and Co., so arranged as to work either separately or together. The fuel used is *charbon maigre*, or non-flaming coal, from the Anzin mines. A test of the coal consumption has been carried out on a working scale by seeing what was done with two waggons of 10 metrical tons each. This supply was found to last 194 hours of constant working, with a steady load upon the engine all the time, indicating 280-horse power, which was equivalent to 220 brake horse power. The gross consumption of coal taken upon the commercial footing, without deduction for ashes, showed that the engine used 1·03 lbs. of coal per brake horse-power. Three months later, a second precisely similar test showed the results practically the same, or, if anything, slightly better.

A Smoke-Bleaching Device.

A so-called "smoke-bleaching" apparatus of a very simple character has been devised by Mr. James T. Sands, of St. Louis, and is reported to have been applied successfully to the power chimney of a large office building in the city, which previously gave trouble by smoking. It comprises an extension of the exhaust steam-pipe, either externally or inside the chimney, to within about 4 feet of its top. Live steam can also be turned into this pipe in case of emergency. The effect is the production, by the discharged steam, of a "vacuum," and at the same time a "slight down-draught" is also caused, carrying the soot saturated with moisture from the steam down to a soot-box placed to receive it at the bottom of the shaft. An efficiency of 96 per cent. of soot precipitation is claimed for this device, by analysis. The precipitated soot was found to consist of 63·68 per cent. of ash, mostly metallic; 34·26 per cent. of combustible matter, mostly carbon with some salts of ammonia; and 2·06 per cent. of moisture. Close observation of the working of the arrangement over the past eight months furnishes some curious effects. Usually nothing visible comes from the chimney, although it is 3 ft. 6 in. internal diameter, and has a 6-inch steam-pipe discharging within 4 feet of its top. The weight of soot collected in the box averages 150 lbs. per month, although there are some days when the atmospheric conditions appear to defy precipitation. These are the hot, humid days, when all chimneys are observed to smoke their worst. Then the "smoke-bleacher" can do no more than reduce the black smoke to a light grey or straw colour. In any case, these claims could easily be tested.

* An abstract of the English patent specification appeared in the JOURNAL for Oct. 2, p. 651.

A New Form of Siemens Furnace.—An announcement was made in the Midlands last Thursday that experiments had been satisfactorily concluded at the works of the Staffordshire Steel and Ingot Iron Company, near Wolverhampton, with a new form of Siemens gas-fired furnace for heating steel ingots. The new plant is, it is stated, intended to re-heat cold steel ingots of great size before they are rolled down; and this application of gas is declared to produce remarkable fuel economy.

The Viscosity of Tar.—An instrument has been devised by Dr. Lunge for observing the viscosity of tar in a very simple manner; and he has given an account thereof, and of its use, in the *Zeitschrift für Angewandte Chemie*. He employs a glass vessel like an aërometer, with a cylindrical bulb below and a narrow tube above, graduated to show specific gravities. He takes a watch in one hand, and the instrument in the other; and at an exact minute he drops the latter into the tar. He then counts the exact number of seconds taken by it to fall to the 1250 mark; and this observation, with the aid of tables, enables the viscosity to be readily ascertained. Care has to be taken that all observations are made at the same temperature.

"Electric Motive Power."—Under this title, Mr. Albion T. Snell, Assoc.M.Inst.C.E., M.Inst.E.E., has produced a work which is designed to be a practical treatise on the subject of the transmission and distribution of electric power by continuous and alternate currents, for the use of mechanical and mining engineers and other students of applied electricity. It has been published by the *Electrician* Printing and Publishing Company, Limited, from whom we have received a copy of the book. Mr. Snell explains in his preface that, assuming his reader possesses an elementary knowledge of the theory of electricity and magnetism, he has endeavoured to give a clear exposition of the principles governing electric transmission of power, and to develop them in accordance with the best practice of the present time. The author deals with his subject in ten chapters; the text being amply illustrated throughout. A useful feature of the book is the list of tables of data and tests; while the list of formulæ will facilitate reference thereto by the student.

Royal Society.—The anniversary meeting of this Society was held on Friday, the 30th ult., when the President (Lord Kelvin) delivered the customary address. Referring to the work of the various Committees during the past year, he remarked that the third report of the Water Research Committee had been issued, giving the results of further experiments by Professor Marshall Ward on "The Action of Light on *Bacillus Anthracis*," and on "The Bacteria of the Thames;" as well as the experiments of Professor Percy Frankland on "The Behaviour of the Typhoid Bacillus and of the *Bacillus Coli Communis* in Potable Waters"—the whole occupying 242 octavo pages. Alluding to the award of the Copley Medal to Dr. E. Frankland, for his eminent services to theoretical and applied chemistry, Lord Kelvin stated that Dr. Frankland's researches in pure chemistry were almost rivalled in interest by his discoveries in physical chemistry, especially in relation to the influence of pressure on the rate of combustion, on the light emitted during combustion, and on the cause of luminosity in hydrocarbon flames. The important work done by him in the study of illuminating gas, water supply, and sewage had proved of great practical value, and had rendered his name famous in connection with the application of chemistry to technical purposes. Lord Kelvin also referred in laudatory terms to the work of Professor Dewar, who was the recipient of the Romford Medal. The award had, he observed, been made in recognition of the services which Professor Dewar had rendered to science by what he had already done, and the provision he had been successful in making for future work, in the investigation of properties of matter at the lowest temperatures. In the evening, the fellows and their friends dined together at the Hôtel Métropole.

TECHNICAL RECORD.

AMERICAN GASLIGHT ASSOCIATION.

The Annual Meeting in Washington.

(*Concluded from p.* 1071.)

Several of the papers presented at the above meeting were taken as read. They have, however, been published in the *American Gaslight Journal*, from which our abstract report of the proceedings has been prepared; and the following brief notice of them will be of interest as supplementing what has already appeared.

Mr. W. S. Rathell, of Cairo (Ill.), contributed "Some Experiences with the Welsbach Lamp." He argued that gas-works managers should not only make all the gas they could sell, but also sell all they could make; and the only way they could secure such a result was by availing themselves of any and every appliance that would give the consumer the best available value for his money. It was with these considerations in view that his Company commenced introducing the Welsbach lamp about 15 months ago. Now some 800 of them were in use in his small town, of which quite half had displaced electric lights. At Cairo he supplied 18-candle coal gas; and with this he had tested the durability, the heating effect, and the illuminating value afforded by the incandescent light. A burner left alight till it failed lasted 1921 hours; and the average consumption was 3·37 cubic feet per hour. The heating effect, as observed by suspending a vessel of water over the incandescent and flat-flame burners respectively, showed that a Welsbach burner using 3·2 cubic feet of gas per hour, gave off as much heat as one of Bray's flat-flame burners, using 4¼ cubic feet per hour. The illuminating value was measured by placing a newspaper cutting on a perpendicular surface in the horizontal plane of the lights to be tested. Finding out the distance from the Welsbach light at which the printing ceased to be legible, it was ascertained that four No. 5 Bray's burners were necessary to give an equal effect. From this it would follow that if the Bray burner gave a duty of 3·6 candles per cubic foot of gas consumed, the Welsbach would give 20·25 candles. In practice, he found that the consumers required one Welsbach for every flat-flame burner displaced—preferring to have the better light than to economize the gas; and they secured an economy of 30 to 50 per cent. as compared with ordinary burners. Comparing the Welsbach burner with the electric light, he showed that gas at 8s. 4d. per 1000 cubic feet was three times as cheap as electricity at 5d. per unit. Though the introduction of the Welsbach burner had reduced the bills in particular cases, his total output was not affected. It had caused a good feeling with regard to gas, which had led to the increased use of stoves and other appliances.

Mr. N. W. Gifford, of New Bedford (Mass.), read a paper on "Light Wasted in Bad Flames." He thought the waste of light following the use of clogged or dirty burners, or having too much pressure at the tip, was not sufficiently appreciated even by gas men; and he illustrated this point by photographs of the same burner under different conditions. The first photograph represented a flat-flame burner using 5 cubic feet of gas per hour at the lowest possible pressure. The second showed the same burner at 12-10ths pressure. It was using 11¼ cubic feet of gas; and yet it yielded only two-thirds of the lighting effect. A third photograph showed a 6-feet burner using 8·07 cubic feet of gas at 16-10ths pressure, and yet only giving half as much light as the first; while a fourth, burning 4 cubic feet per hour at 17-10ths, gave an efficiency of 35 per cent. Here, he said, was the cause of many complaints about big gas bills. The author concluded by a powerful argument in favour of gas companies turning their attention to the manner in which the gas was burned, and assisting their customers to get the best possible value out of the gas.

Another communication was written by Mr. Burdett Loomis, of Hartford (Conn.); and it treated of the use of gas for purposes other than lighting. He thought the time was coming when gas would be valued by heat-units rather than by candle power; and he insisted upon the importance of an organized system for the introduction of gas-stoves. Referring to gas-engines, he stated that the reason these were not more generally used was the lack of "push" on the part of managers of gas-works, and the high cost of the engines. With regard to the latter, he argued that it could be met by a discount on the price of gas, which the gas company could well afford if the engine was regularly worked. Although gas at 4s. 2d. per 1000 cubic feet cost seven times as much as coal at 25s. per ton of 2000 lbs. (which, at 14,000 units per pound, would give 28 million units of heat, and 43,000 cubic feet of gas at 650 units per cubic foot would be required to effect the same result), yet, in practice, there were several features in favour of gas; and it had already made its way, to some extent, in spite of this drawback. Not only was it largely used for cooking purposes, but the advantages of requiring no labour for igniting, leaving no ashes, &c., led to its adoption for heating, particularly in business places and for intermittent use. And there was yet a field for employing it in this direction on a larger scale, by the medium of hot air, hot water, or steam. This was proved by the fact that steam was supplied from central stations for heating purposes. The author exhibited diagrams of apparatus showing the application of gas in this manner. Many houses were, he stated, fitted with a large and a small hot-air furnace, heated by coal—the former for the severe weather, and the latter for the spring and autumn. Gas might be used with great advantage in the small furnace. It was useless to say that the public would not have a thing because it was very expensive. They wanted the best; and they were willing to pay a fair price for it.

Mr. Peter Young, of Knoxville (Tenn.), followed with some remarks on an experimental plant as an aid to the management of a coal-gas works. After enlarging on the importance of knowing the actual worth of any material, and of being able to estimate the comparative value of small samples, he proceeded to describe an inexpensive testing-plant, intended for practical working rather than for scientific research, which he had provided for his own use some two years previously. He built up, out of old fire-brick, a small bench 4 feet long, 3 feet wide, and 5 feet high. The furnace was 12 inches wide, and the retort was set on a tile directly over it. The products of combustion went to the back, then forward over the tile and retort, and finally out at the top. The retort was made of iron, 6 inches inside diameter, an inch thick, with the usual fittings for the lid, and a 2-inch ascension-pipe. The condenser was made of 1½-inch wrought-iron pipe, with outlet for tar, &c., at the bottom of each upright. Then there was a washer 18 in. by 12 in. by 9 in., of iron plate, and a purifying-box 2 ft. 6 in. square by 1 foot deep. The gasholder and tank were made of wrought iron; the holder being 3 feet in diameter and 5 feet deep; and a 20-light experimental meter was used to measure the gas. The outlet from the holder was connected to a photometer, and also to the works supply, so that the holder could be filled from, or emptied into, the service as might be desired. For a charge, 4 lbs. of cannel, or 5 lbs. of bituminous coal, were employed. The whole did not cost £20; and it had paid for itself over and over again.

At the conclusion of this part of the business, attention was directed to the Question-box. Discussing the relative advantages of steel and iron pipes for services, Mr. Cowdery said steel pipes were smoother inside; but he admitted that they were harder for the die, and required more labour in fitting than wrought-iron pipes. It appeared that steel pipes had not been in use for a sufficient time to decide the question of comparative durability. On the question of using tarred or plain yarn for cement joints, Mr. Pinckney preferred the former, because it would pack tighter than the plain yarn. Mr. Norris suggested that the gas might dissolve the tar. Mr. Addicks said that for lead joints, equally good connections could be made with either; but he preferred the tarred yarn, as being less liable to spring. In reply to a question as to what allowance for shrinkage of water gas should be made, apart from the effect of temperature, in its passage from the relief holder through the purifying apparatus to the storeage holder, Mr. Clark made the significant reply that it depended upon whether lime or oxide was used. If the latter, the shrinkage would be under 1 per cent.

Mr. Addicks then submitted a report of the Committee on Federation, which had been agreed to by a Conference Committee, comprising representatives from the Ohio, Western, and New England Associations in addition to their own. The Michigan and Pacific Slope Associations did not take part. This report had been considered by the Council; and they had decided that it should go before the members. It included a full draft of constitution and bye-laws. This draft was read to the meeting by the Secretary. The proposed title was "The Federation of Gas Associations in America;" and there was to be no individual membership, but membership by Associations. The only officer elected by the Federation would be the Editor of the journal; the affairs being managed by Committees selected by the Associations. A Journal was to be published quarterly, to include notices of patents, current literature, &c., in addition to the proceedings of the Associations; and each member should be entitled to one copy only, but might secure extra copies by purchase. Full arrangements for putting these matters into operation were included, as were several minor details.

A considerable amount of discussion followed the reading of the proposed rules. Mr. M'Keige objected strongly to increased expenditure on "Proceedings," or to going into the publishing business, which he described as out of the latitude of the Association. The existing periodicals were willing to publish reports promptly; and he thought they should not be hampered in any way. He objected to waiting three months for his report; and said that the price of the proposed *quarterly* was too high for the poorer gas companies. Mr. E. C. Brown followed on the same lines. He also urged that federation was beyond the province of the Association, and unlikely to further its objects. There was no precedent whatever for curtailing the liberties of the press. Mr. M'Ilhenny wanted his report promptly; and he also wished absent members, and those of other Associations, to have the same privilege. The gas journals had done much for the Associations; and they should not be interfered with. Mr. M'Donald urged that the gas press or a little extra expenditure was not the only consideration, but that the future usefulness of the Association and the good of the fraternity should be taken into account. Mr. Addicks pointed out that each of the

Associations retained the right to publish its proceedings in any way it chose; and he also argued that a great reduction in the costs to each separate Association for publication would follow the adoption of the report. After further discussion, a resolution to postpone the subject was put to the meeting, and lost. The resolutions of the Committee were then submitted; and they were lost by a vote of 29 to 28.

The Secretary then spoke on the subject at some length. He said that the *Quarterly* was under the control of the Association, and could be published next week if they chose. So far from increasing the expenses of publication, the federation scheme proposed to reduce them. As to there being no precedent, he produced Vol. XIII. of the "Journal of the Association of Engineering Societies." Federation was simply co-operation; and those who talked about not knowing what it might lead to, had a very indistinct idea of the matter. As to the advertisements, which had been called "extorted tribute," no one was asked or compelled to advertise; nor was it likely that anyone would do so, if it did not pay. The relation of the matter to the established gas press was a serious problem. He quite agreed with supporting the gas press as far as possible; but he considered the Association quite at liberty to limit publication if thought desirable.

After some further discussion, the meeting closed with the usual votes of thanks.

THE COLOUR OF THE INCANDESCENT GAS-LIGHT.

In a recent issue of the *Electrical Review*, the results were given of some experiments made by Herr von K. Mützel, and communicated to the *Elect. Zeitung*, on the intensity of the different colours in the spectrum of a Welsbach incandescent gas-light, as compared with the corresponding colours in the spectra of the incandescent electric light, the arc light, and sunlight. The comparisons were made by means of a Glan-Vogel spectroscopic photometer. The relative brightness of each colour in the two spectra compared was estimated on the assumption that the yellow light was of equal brightness in both. The following table gives the ratio of the electric incandescent light, the arc light, and sunlight, respectively, to the Welsbach light:—

Wave Lengths in Millionths of Millimetres.	Colours.	Ratio of Electric Incandescent to Welsbach Light.	Ratio of Arc to Welsbach Light.	Ratio of Sunlight to Welsbach Light.
800	Extreme red . . .	4·04	0·57	0·34
760	Red	2·59	0·73	0·53
686	Do.	1·67	0·80	0·62
656	Orange	1·15	0·90	0·92
589	Yellow.	1·00	1·00	1·00
570	Do.	0·95	1·08	1·19
542	Yellow green . . .	0·83	1·23	1·72
527	Green	0·81	1·66	2·13
517	Do.	0·79	2·02	2·60
500	Blue green . . .	0·91	2·48	4·35
486	Bright blue . . .	1·00	3·32	5·91
466	Do.	1·05	4·06	6·79
458	Do.	1·10	4·69	7·69
447	Dark blue. . . .	1·20	6·67	8·75
431	Do.	1·36	10·52	12·63
423	Violet	1·51	18·32	18·77
416	Do.	1·74	28·78	25·54

This table shows that the electric incandescent light has more red than the Welsbach light, but that in the green colours the latter excels the electric light. In the bright blue, the two kinds of light are almost equal; while in the violet the electric lamp has again a slight advantage. In the arc light, the numbers increase steadily from the red to the violet. It therefore follows that this light is inferior to the Welsbach in red and orange rays, but far exceeds it in blue and violet rays. Much the same is true when sunlight is compared with the Welsbach light. The results of Herr Mützel's experiments show that, where warm colour tones are required, the incandescent electric light is to be preferred to the Welsbach light, and where cold colour tones are to be avoided, the latter is to be preferred to the arc light.

Another Gas-Enriching Material.—We learn from *Industries and Iron* that a curious bye-product in the manufacture of aluminium and the reduction of refractory ores has been found in the shape of carbide of calcium, from which acetylene is obtainable. Acetylene has a high candle power when used as an illuminating agent; but the difficulty has been to obtain it cheaply enough to enable such a use to be made of it. Our contemporary remarks that "it is significant that this latest addition to the gas engineer's resources should have its origin in a strictly electrical process. Should it be found to fulfil all the hopes cherished by those who have tested the process experimentally, we may some day meet the anomaly of an electric generating plant being worked to make illuminating gas. This could easily happen if the value of acetylene were sufficiently great to render its production in large quantities in this way advisable."

REGISTER OF PATENTS.

Water-Meters.—Bel, J. E. A., of Barcelona, Spain. No. 21,190; Nov. 7, 1893.

The construction of this water-meter is based upon the use of a membrane serving as a measuring device, and adapted to move between two hemispherical grates or bells perforated with holes, and which consequently displace a constant volume as it passes from one grate to the other. The water which moves the membrane passes through one or the other of the perforated bells, according as two pairs of pistons, combined with a distributing slide-valve, send it through suitably arranged orifices or channels to one or other part of the chamber, wherein are contained the bells limiting the movement of the membrane.

The patentee states his claims to be for a water-meter having juxtaposed a measuring chamber and a distributing chamber, and in which the measuring device is formed of a membrane which, being arranged in the measuring chamber between two fixed grates or bells perforated with holes and limiting its movement, is moved by the automatic operations of double pistons, adapted to be displaced in separate cylinders. Each of these double pistons actuates a distributing slide-valve, for covering or uncovering alternately the ports of a distributing box, the orifices of which are arranged in such a manner that one of the double pistons follows the movement of the other double piston, and *vice versâ*. This causes the water to pass to the measuring chamber on one or the other side of the membrane; the registering mechanism being operated by an oscillating finger arranged on the rod of one of the double pistons, and acting upon registering mechanism of any known construction. The arrangement is such that the displacements of the membrane from one bell to the other effect the measuring of the water traversing the meter without the membrane having to raise or carry away any part for causing the change of motion of the double pistons and their slide-valves—the change taking place automatically by the pressure of the water to be measured.

Centre-Valves for Gas-Purifiers.—Sisson, W., and Holt, R., of Manchester. No. 21,796; Nov. 15, 1893.

This invention relates to centre-valves used in connection with gas-purifying apparatus. In an ordinary type of such valves, as at present in use, say the patentees, plungers or discs are raised and lowered, so as to cut off or divert at certain points the flow of gas passing through the centre-valve box; but these plungers or discs are "liable to stick, and are difficult to work, besides allowing foul gas to leak past and enter the gasholder in an unpurified state." They accordingly prefer to substitute for the plungers or discs a system of liquid seals, which they claim "perform all of the required functions, while being much more economical and easy to work."

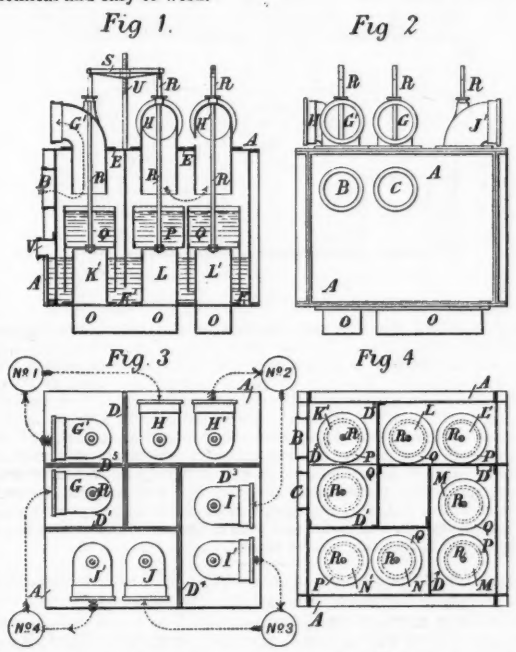


Fig. 1 is a vertical section; fig. 2, a side view; fig. 3, a plan; and fig. 4, a horizontal section of the valves.

The valve or trap-box A is made of any suitable size and shape; and in the side of the box A is formed a gas-inlet B and a gas-outlet C—the inlet being connected to a pipe leading from the condenser and washer, and the outlet leading to the pipe which conducts the gas to the holder. The arrangement here shown is intended to serve four purifiers; the box A being divided off by four partitions D, reaching from the top cover E to within a short distance of the bottom F, near which they dip into liquid in the bottom of the box, so as to seal the partitions. There are four pairs of dip-pipes G G^1, H H^1, I I^1, J J^1; each pair leading to and from one of the purifiers. Opposite to the dip-pipes, but at the bottom of the box, are eight stand-pipes K K^1, L L^1, M M^1, N N^1; each pair communicating with the pair on the other side of the partition, by means of bye-pass conduits O, secured to the bottom of the box. In conjunction with the dip-pipes are eight liquid seals, consisting of four single buckets P, and four double buckets Q; each bucket being hung on a rod R, which passes up through a packed gland in the bend of the corresponding dip-pipe. The rods R are suspended, in pairs, on cross-bars S, mounted on a screw U; and by turning the screw, the buckets can be raised so as to seal the lower ends of

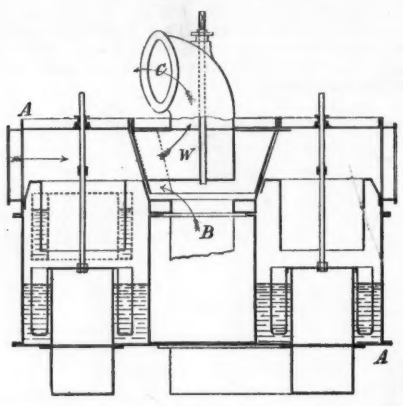
the dip-pipes, or lowered so as to cut off access to the stand-pipes and bye-pass pipes. An overflow V, for the tar and liquor collecting in the box, is also provided. The sealing-buckets P Q are kept filled by the liquor of condensation from the pipes above.

The operation of the apparatus is as follows: The gas is passed from the condenser and washer into the valve-box, through the inlet B. The purifiers—represented by the numbers 1, 2, 3, and 4—are arranged around the centre-valve. If all four purifiers are working, all the eight bucket-seals P Q are lowered; closing the stand-pipes, and allowing the gas to pass from the inlet through the first dip-pipe G^1, to the first purifier No. 1, as shown in figs. 1 and 2; thence through the dip-pipes H H^1, to purifier No. 2; thence through the dip-pipes I I^1, to purifier No. 3; and finally through the dip-pipes J J^1, to purifier No. 4. From purifier No. 4 the gas passes through the dip-pipe G to the outlet C, through which it proceeds to the holder.

Suppose it is desired to renew the material in purifier No. 2. The proper screw U would be operated to raise the two necessary sealing-buckets P Q, so as to close the dip-pipes H^1 and I, which communicate with purifier No. 2. No. 2 is thereby shut off from the box A; and the gas passes direct from the dip-pipe H, *via* the bye-pass O, to the dip-pipe I^1, through which it flows to purifier No. 3. Passing through No. 3, it proceeds to the dip-pipe J; and thence through the dip-pipe J^1, to purifier No. 4. From purifier No. 4, the gas is delivered to the dip-pipe G; and from the latter, it flows through the outlet C to the holder. The dip-pipe G and outlet C are separated from the compartment containing the dip-pipe G^1 and inlet B by a partition D5, so that the mixing of the purified and foul gas is impossible. By this arrangement, purifier No. 2 is skipped, and the contents may be dealt with in the required manner; the rest of the purifiers Nos. 1, 3, and 4 working on without interruption. In the same manner No. 1 might be skipped, by closing the dip-pipes G^1 and H; No. 3, by closing the dip-pipes I^1 and J; and No. 4, by closing the dip-pipes J^1 and G—the gas in every such case passing the blocked dip-pipes by means of the bye-passes O.

To increase the capacity of the apparatus for shunting the currents of gas, a moveable shunter is placed in the centre of the apparatus, whereby the current of gas can be taken from any one of the partitioned-off spaces communicating with the purifiers. In this way, it is claimed to be possible to ring a greater number of changes upon the shunting of the currents and the skipping of the purifiers. This moveable shunter is shown in fig. 5, marked W. The inlet-pipe B leading

Fig 5

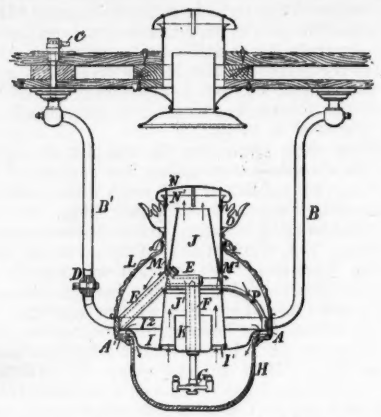


into the centre of the apparatus discharges into the conical space in which the shunter moves. This consists of a hollow conical tray, supporting and containing a hollow passage, which communicates with the outlet-branch C. The gas admitted through the inlet B passes through a port to a partitioned-off space, and thence to the opposite connected purifier, whether such purifier be No. 1, 2, 3, or 4—this being fixed by the position into which the shunter has been turned. On returning from the purifier, the gas passes to the next; and so on, in the manner already described. The gas is finally delivered through the cone, and is led to the central outlet C. The shunting cone is hung on a central rod, which projects upward through a packed gland in the outlet-branch, and is formed with a squared head to fit a key or wrench by which the cone can be turned.

Gas-Lamp for Railway Carriages.—Imray, H.; communicated from E. Picard, of Brussels. No. 23,095; Dec. 1, 1893.

This railway carriage roof-lamp—attached to a reservoir of compressed gas—is carried on a ring A, suspended from the roof by four bent tubes B, one of which B^1 is connected to the gas supply-pipe C on the roof of the carriage, and is provided with a stopcock D. From the part of the ring to which this tube is attached, a branch E leads inwards to a central tube F, which carries at its lower end four burners G within a glass basin H, the edge of which has a lip resting on the ring A^1 attached to the suspended ring A. The ring also carries a reflector I, which extends over the burners. It is formed with a central hole I^1, through which the products of combustion pass to a chimney J J^1 above, of which the upper part J is supported by ribs P fixed to the ring A. The lower part J^1 of the mica chimney rests on the reflector, and within this part, surrounding the descending gas-tube, is a vertical cylinder K, having a surface for reflecting through the mica such light as may pass through the hole of the reflector below. An inverted hemispherical basin L of opal glass, or having an ornamented or frosted surface, rests by its lower edge on the suspended ring A; its upper edge nearly meeting a casing M, which surrounds the chimney, and which passes up through the glass basin.

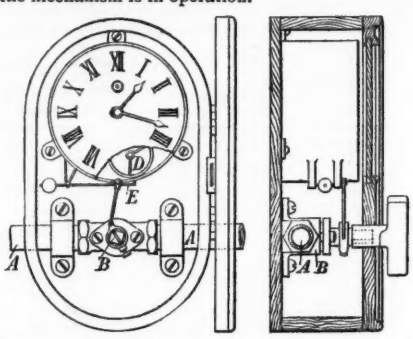
When in action, air passes through shielded perforations M^1 of the casing M above the glass into the annular space between the chimney and the casing; and a portion of the air flows from this space through lower perforations M^2 of the casing into the space within the inverted



glass basin L, whence air passes through perforations I^2 of the reflector near its outer edge, into the glass basin below, to supply the flames. The chimney is covered by a cap N, having lateral shielded perforations N^1 for the escape of the products of combustion; and an outspreading ornamental rosette O conceals the upper part of the chimney and its cap from view from below.

Indicating the Time during which Gas has been Consumed.—Curtis, F. G. S., of Shaftesbury Avenue, London. No. 24,730; Dec. 22, 1893.

The object of this invention is to provide means for use, in combination with conduits for the supply of gas or other fluid or conductors of electricity, for indicating the time during which the gas, &c., has been consumed. This is accomplished by combining with the conduit or conductor a time-keeper, provided with a device which can be brought into position to stop the time-keeper, or into a position to release it. These operations are effected by the tap (or the switch) by which the supply of the gas or electricity is opened or closed. The mechanism is enclosed in a case, provided with a glazed front, through which the time-keeper can be seen; and thus it can be readily ascertained during how long a period the supply has been open, as it is only during such time that the mechanism is in operation.



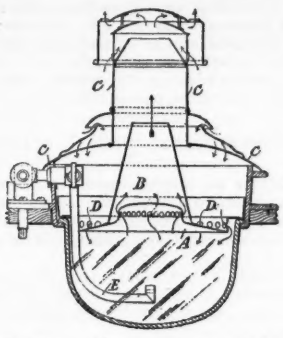
In the illustration, A is the pipe for gas leading from the source of supply to the place of consumption, and provided with a cock or valve B, for opening and closing as required the passage for the fluid. This cock is contained in a box or casing, provided with a door which, when closed, may be secured, so as to prevent access to the interior of the box except by the person provided with the key. In the box is a clock or time-keeper, in proximity to one of the wheels of which is a detent or catch E, arranged so that one part can engage with the wheel to stop the clock. It is connected by a rod or wire to a lug on the plug of the cock B; so that, when the plug is turned to open the passage for the fluid through the pipe A, the detent or catch E is caused to disengage the wheel of the clock, and permit of it working—the clock continuing to work so long as the plug of the cock or valve B is in the position to open the passage through A. When the plug is turned so as to close the passage, the connecting rod or wire will allow the detent (under the action of a counterweight) to engage the wheel D, and thereby stop the clock.

In the drawing, the detent E is shown as acting on the balance-wheel of the time-keeper; but it may be arranged to act on any other suitable wheel. The end of the rod or wire which is connected to the detent E is slotted as shown, to admit of the movement of the plug of the cock without operating the detent before opening the passage through A. The plug of the cock is shown in the front view in the position it occupies when about to commence opening the passage through A, and the detent E about to disengage the wheel D.

Lamps for Overhead Lighting.—Thomas, T. C. J., of Finsbury Park, London, N. No. 25,087; Dec. 30, 1893.

A lamp according to this invention is constructed with a burner enclosed within a bowl, and having above it a reflector pierced by an annular row of holes, for the escape of heated air and products of combustion from the bowl into the chimney; air to support combustion being admitted to the bowl, around the periphery of the reflector, near the rim of the bowl.

In the engraving, the reflector A resembles a truncated hollow cone, with a central flattened dome or cap-like part B, that stands up within the lower part of the chimney, to which the reflector is secured. The holes through which the heated air and products of combustion escape from the lamp-bowl into the chimney are made through the annular



wall of this central part. Air to support combustion reaches the burner through holes in the head C of the lamp, and through holes D in a vertical wall arranged around the periphery of the reflector, near the rim of the bowl. The reflector is provided at its periphery with an annular horizontal flange, by which it is supported upon a flanged ring like that ordinarily used for securing the lamp-bowl within the lamp-casing; the flange being recessed at one side, so as to accommodate the pivoted gas supply-pipe E.

Distributing and Igniting Device for Gas and Petroleum Engines.—Lake, H. H.; a communication from F. Krupp, of Magdeburg-Buckau, Germany. No. 752; Jan. 12, 1894.

This invention—relating to the distributing and igniting devices of gas, petroleum, and like engines—has for its object to cause the ignition to vary with the cut-off (that is to say, to take place sooner or later according as the cut-off is early or late), for the purpose of ensuring "a very economical consumption of the explosive charge, and a uniform speed of the engine." The proportion of the residues of combustion of one charge to a new charge is greater when the cut-off is early than when the cut-off is late; and the ignitibility of the charge is thereby diminished. Consequently the ignition should take place proportionately earlier when the cut-off is early, in order that the combustion or the utilization of the charge may be complete. This object is secured by providing for the operation of the distributing or admission valve or cock by an eccentric, or equivalent device, which has a variable lead under the control of the governor; and by arranging the valve or cock to operate the igniting-valve in accordance with the requirements—that is to say, sooner or later in proportion to the varying angular advance of the eccentric.

Manufacture of Combustible Gas.—Imray, O.; a communication from La Société Anonyme des Moteurs Thermique Gardie, of Nantes, France. No. 4283; Feb. 28, 1894.

This invention relates to a process for the manufacture of combustible gas under a minimum pressure of 3 kilos. per square centimetre, or about 40 lbs. per square inch.

For this purpose, in a hermetically closed gas-producer, constructed so as to resist high pressures, and lined with refractory material, there is maintained a constant volume of materials rich in carbon. Into this producer is forced heated compressed air, under a pressure of 3 kilos. or more, as also a comparatively small quantity of steam (preferably superheated), at a pressure which is regulated according to that of the compressed air. This steam is intended for enriching the combustible gas by its decomposition in the producer. The combustible gas issues from the producer at the pressure at which the compressed air was introduced.

This process is claimed by the patentees to be new, inasmuch as combustible gas is usually manufactured under atmospheric pressure (or only a little above it) in the ordinary apparatus, and produces phenomena which have hitherto been unknown. The effect of the high pressure, and of the high temperature produced thereby in the gas-producer, is to prevent the formation of carburets of hydrogen with high equivalents, and to promote the formation of hydrocarbons with low equivalents. The combustible gases produced are, in fact, deprived of condensable carburets, tar, pitch, light or heavy oils; and they contain the hydrocarbons C_2H_4 in large quantities, and very little of the hydrocarbons having the composition C_4H_4. There is also in these gases no trace of ammoniacal products, ammonia, or cyanides, as the high pressure and temperature favour the combination of the carbon, and not of the nitrogen.

The gas thus produced is said to burn in the open air with an illuminating flame, without trace of smoke. Its calorific power at 0° C. and 760 mm. pressure, is more than 1600 calories per cubic metre, as shown by experiments made by M. Witz, Professor of Lille University, by means of his calorimetric shell. The mean volumetric composition, determined by more than a hundred analyses by M. Maisonneuve, is as follows; the gas being made in a producer supplied with anthracite from Swansea:—

H	15·0
CO	24·5
C_2H_4	5·5
C_4H_4	0·5
CO_2	3·0
O	0·5
N	51·0
	100·0

The consequences of these various properties are claimed to be of the greatest importance, involving as they do: (1) Suppression of all scrubbers, washers, condensers, &c.; the gas produced being permanent, entirely free from condensable hydrocarbons, and leaving no deposit in the pipes. (2) Suppression of gasholders, in consequence of the instantaneous production according to the requirements, and very considerable reduction of the dimensions of the gas-producing apparatus. These results are the consequence of the pressure of 3 or more kilos. employed and of the high temperature, which render the producing power of the apparatus independent of its dimensions, and permit an instantaneous production through the increased weight of the elements in the producer, and the increase of the speed of circulation of these elements.

The pressure of 3 kilos. has been taken as the minimum, because it is only at this pressure that the production of a gas commences that is free from all condensable carbons. Up to that pressure the phenomenon is only incompletely produced; the improvement becoming greater the higher the pressure, and becoming complete at 3 kilos. and upwards. The improvement is also greater, the higher the temperature. The producer is therefore lined with refractory material; and the steam is superheated. The high pressure also aids in producing the indispensable condition of high temperature.

The following table (from the specification) gives a comparison of two analyses made—the one of gas produced by the gas-producer under pressure, the [other of gas produced by the Dowson process, which is the process for the manufacture of combustible gas at atmospheric pressure that most nearly approaches the process according to this invention. This gas was taken from the Dowson holder after having been purified and freed from condensable carburets, pitch, tar, &c., and the ammoniacal products with which it is always charged; whereas the improved gas was taken directly from the gas-producer.

Calorific Capacity.

Dowson Gas. Composition in Volume at 0°–76.		Calorific Capacity.	Gardie Gas. Composition in Volume at 0°–76.		Calorific Capacity.
H	18·63		H	15·00	
CO	25·07		CO	24·00	
C_2H_4	0·31		C_2H_4	5·50	
C_4H_4	0·31	1311·10 calories.	C_4H_4	0·50	1648·95 calories.
N	49·08		N	51·50	
O	0·03		O	0·50	
CO_2	6·57		CO_2	3·00	
	100·00			100·00	

This comparison, the patentees remark in conclusion, demonstrates the difference in richness of the two gases, which is entirely to the advantage of the gas produced by the present invention, as this gas has a calorific capacity of 1600 calories, whereas the Dowson gas scarcely reaches 1400 calories per cubic metre.

As already stated, any combustible matter rich in carbon can be employed for the process of manufacturing combustible gas under pressure—in particular petroleum, which can be introduced in various ways, such as by means of the steam injected into the apparatus.

Furnaces for the Burning of Fuel to Obtain Smokeless Combustion.—Fell, J. C.; a communication from M. M. Armstrong, of Philadelphia, U.S.A. No. 12,888; July 3, 1894.

This invention relates to the conversion of fuel into combustible gases by the aid of air or air and steam, whereby hydrocarbons or other volatilizable portions of the fuel are prevented from becoming afterwards condensed in the form of smoke or soot, but are completely utilized with the other combustible portions of the fuel.

Briefly stated, the method consists in first igniting a charge of fuel in a furnace chamber or retort of considerable length, and permitting it to burn by natural draft until the combustion of the entire fuel column has commenced. The products of combustion, during this stage of the operation, are permitted to escape, after which the vessel is closed, and currents of air more or less heated are passed transversely through perforations in the retort or furnace. The fuel column (as it is consumed) progresses through the furnace or retort, and farther on in the length of the retort returns the gaseous products, with an additional quantity of air or air and steam, transversely through a portion of the fuel in the retort or vessel which has previously been treated, and partly consumed. It repeats this operation of returning the products of combustion with air, or air and steam, any desired number of times; so that the hydrocarbons and other combustible portions of the fuel become converted into combustible gas, which does not precipitate carbon.

As the fuel column in the retort is consumed and subsides, additional fuel is added from time to time. This ignites from that already in the retort, and also from the heat of the retort, so that the operation is continuously maintained, and a continuous supply of fuel gas (susceptible of smokeless combustion) is discharged.

The apparatus for applying the process to the generation of steam, and which forms a feature in the invention, operates by circulating water through part of the fuel chamber, so as to preserve the chamber from being impaired by heat, and at the same time augment the steam-generating capacity of the whole apparatus.

Gas or Oil Heating or Cooking Stove.—Stonely, A. J. and A. A., of Tonbridge and Richmond, respectively. No. 13,519; July 12, 1894.

This invention relates to stoves for cooking and heating purposes which derive their heat from either oil or gas, as preferred. The stove consists of a central chamber forming the oven, with a gas-burner or oil-lamp on either side of the interior, connected to a gas supply or a reservoir for oil—such reservoir being attached to a cast bedplate. The burners have chimneys of glass or mica, above which are flues for carrying off the vitiated air; and these flues may pass upwards through a boiler, for heating water, if required. The oven is fitted with shelves, at the ends of which space is left for the burners; and the door is furnished with ventilators, and has a glass panel, whereby the articles being cooked can be examined without opening the door.

Gas-Engines.—Vermersch, A., of Lille, France. No. 13,524; July 12, 1894.

This invention has for its principal object to simplify the construction and to reduce the consumption of gas in engines, and to diminish the maintenance. It consists essentially "in the special arrangement of the frame in conjunction with the cylinder and the adjacent parts," the claims for which are: (1) The arrangement of inspection covers for the removal of incrustation. (2) Regulating the speed of gas-

engines, by the resistance of the displacement of air. (3) The special igniter-tube described. (4) The air and gas injector. (5) The general arrangement of piston-rod and crosshead, enabling the compression to be regulated. (6) The arrangement for the escape of burnt gas into the base of the frame. (7) The arrangement of the starting movement.

Vapour or Gas Motor Engine.—Bryant, C. H., of Chiswick, Middlesex. No. 14,476; July 27, 1894.

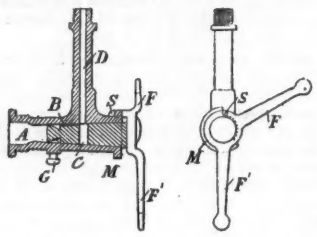
This invention relates to a motive-power engine, operated by an explosive mixture of atmospheric air, or other gas capable of supporting combustion, with the vapour of benzoline, naphtha, petroleum, or other hydrocarbon oils, or coal gas.

The most important features claimed for the invention are: (1) Its economy in the consumption of the motive power employed, especially when hydrocarbon oils are used, arising partly from the manner in which the speed governor operates upon the exhaust-valve, at the moment when a fresh supply of explosive mixture is being drawn in by the suction of the upstroke of the working piston, and partly by utilizing the otherwise waste heat given off from the combustion chamber for vaporizing the oil. (2) An improved speed governor constructed and arranged to operate upon the exhaust-valve. (3) An improved arrangement of valves, by means of which, and their accessories, the need of a pump for drawing in the explosive charge is dispensed with. (4) A lever, actuated by the rod of an eccentric, and by which the exhaust-valve is regularly opened at the finish or other part of each alternate cycle of the crank-shaft.

Although in the drawings accompanying the specification, the patentee has illustrated his invention by showing a vertical engine constructed for use with hydrocarbon oils, it is to be understood that, by a simple and easy modification and disposition of the parts, the engine can be arranged to operate as a horizontal engine, or to be actuated by the combustion of an explosive mixture produced from a combination of gases other than that of vaporized hydrocarbon oils—such, for instance, as atmospheric air and coal gas or carburetted hydrogen.

Gas-Cocks.—Handel, T., of Ilminster. No. 15,063; Aug. 7, 1894.

This invention relates more particularly to gas-cocks intended for street-lighting purposes; and it consists essentially in placing the levers for turning the gas on and off " in a more convenient and handy position for actuating same than heretofore." The cock is constructed in the ordinary manner; the gas passing through a passage in the plug and through the usual passage in the cock to the burner, while the double armed lever for turning the gas on and off is placed in such a position that one of the arms is always vertical, and consequently easier to operate than those hitherto constructed.



The gas enters the cock at A, and passes through the passage B in the plug into the hole C, whence it passes through the tube D to the burner. The set-screw G serves to keep the plug in position; while a projecting pin S is provided, which comes into contact with the edges of the flange M in the " on " and " off " positions. The double-armed lever FF1 is placed in such a position that the lower arm is always vertical, so that the gas can be easily turned on and off by simply pushing up one of the arms.

Gas Motors.—Schimming, G., of Martinickenfelde, near Berlin. No. 15,109; Aug. 7, 1894.

This invention relates to the conversion of heat in gas motors, by means of a special method of water-injection in the working cylinder, and of expanding the motive agent generated in that cylinder.

The loss of power in gas-engines is chiefly two-fold, the patentee remarks—(1) Owing to the lowering of temperature by cooling with water, from 27·1 to 47·1 per cent. of the available caloric is wasted in gas-engines as now constructed. (2) Owing to the fact that the exhaust gases escaping from the motor have a temperature of from 600° to 800° C., 37·9 to 42·3 per cent. of the available caloric is wasted. The loss of power specified above in (1) may be reduced by a water-injection, arranged to take place in the exploded mixture during the working stroke, and thereby characterized. (*a*) That the water-injection does not take place during the combustion, in order that the gases, during combustion, may not be lowered in temperature below the point of ignition, which would cause the combustion to be incomplete, and result in an unfavourable working of the engine. (*b*) That the water-injection is not too weak, so as to be ineffective, and render necessary a further external cooling with cold water, nor yet too strong, which would reduce the temperature of the gases during the working stroke. That is to say, the water-injection must cease so soon as the gases and combustion products during the working stroke have attained that exact degree of tension (or expansion) at which, having regard to the durability and maintenance of the working parts, the highest admissible temperature of the gases is obtained. (*c*) That degree of tension or expansion may be experimentally determined for each motor and each kind of gas or vapour individually.

Combined Coal and Gas Cooking-Range.—Stecke, A., of Osnabruck, Germany. No. 15,851; Aug. 20, 1894.

This invention relates to a cooking-range adapted to be heated by means of either coal or gas or both. It has fixed gas-burners, arranged in the draught flues of the range; and these act in conjunction with hoods protecting them from the action of the fuel gases or smoke, when coal alone is being burned. A protective collar-piece fits closely around the neck of the burner; the aperture in it being capable of adjustment by means of sliding plates, so as to prevent the fuel or smoke from penetrating to the burner, and so enabling the range to burn coal and gas at the same time.

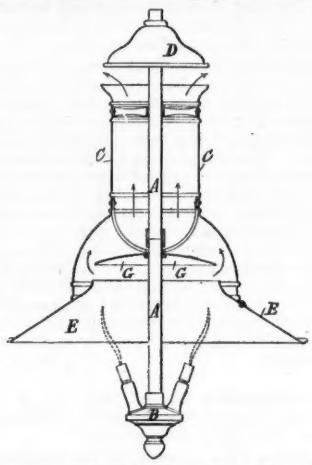
Gas-Burners with Globe Supports.—Bray, G., of Leeds. No. 16,295 Aug. 27, 1894.

This invention relates to improvements in "Bray's adjustable burner," which consists of two burners, one above the other; the present improvement having for its object the arrangement of the burners in such a manner that the ordinary globe-holder is supported by the burner itself.

The burner is formed in two parts; and the lower portion has formed or shrunk thereon a flange, above which sufficient metal is left to admit of same being screwed to form a suitable support for an ordinary globe-holder.

Gas-Lamps.—Cowan, T. W., of Rotherham. No. 17,142; Sept. 8, 1894.

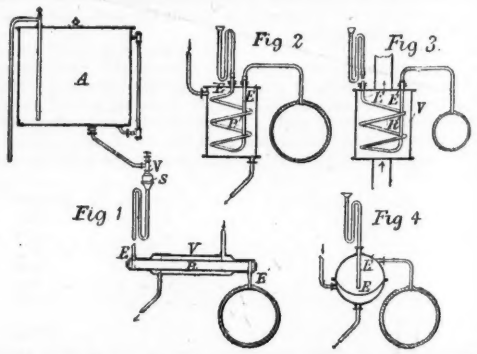
The illustration represents in vertical section a lamp constructed according to this invention. A is the tube for the supply of gas to the chamber B and thence to the burners, preferably such as give flat flames in incling outwards. The chimney C is supported upon the gas-supply pipe by arms or brackets. Also supported by the tube is a cap D, leaving space between itself and the upper end of the chimney for the escape of the heated air and products of combustion. The



lower part of the chimney is bell-shaped; and to it is secured the funnel-shaped mouthpiece E, extending outwards beyond the flames and inwards to within the bell-shaped part. Secured to the tube A is a deflector G, extending over the top of the mouthpiece, and leaving a space between itself and the top of the mouthpiece. The deflector is preferably made cup-shaped or part of a sphere, with its concave side downwards, and enamelled white.

Carburetting Gas.—Bremme, F., of Gleiwitz, Germany. No. 17,679; Sept. 17, 1894.

One disadvantage of all apparatus employed for carburetting gas hitherto proposed, says the patentee, is that by using a carburetting liquid which consists of ingredients having different vaporizing points, the most volatile parts evaporate first, and the less volatile remain behind. The consequence is a continual decrease of evaporation, and an irregularity in the carburation takes place, which is still more or less governed at every outside change of temperature. In order to obviate this disadvantage, the controllable quantity of carburetting liquid flowing in continually is in the present mode of treatment immediately evaporated, so that no kind of residue of liquid can collect in the evaporator. The quantity of the carburetting liquid evaporated at a fixed time, and conducted to the gas, depends then solely on the inflow.

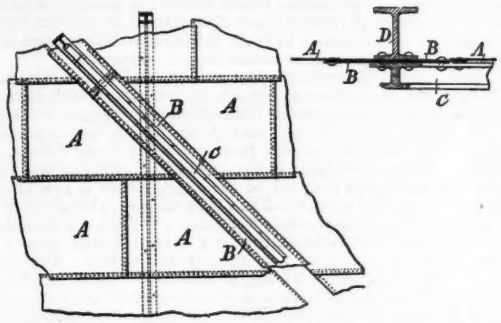


The storeage cistern A for the carburetting liquid is constructed like a Mariotte flask, so that the quantity flowing out is not affected by the state of level of the liquid. Into the tube connecting the cistern with the evaporator V R, is properly fitted a regulating-valve N; and under it is an inspection bulb S, by which the inflow can be ascertained and regulated—the jet of the outflowing carburetting medium being visible (fig. 1).

For this purpose, the evaporator consists of a horizontal, or of a slightly inclined tube R (fig. 1), or a sinuous or a coil tube R^1 (figs. 2 and 3), provided with a casing, or of a vessel with a double bottom (fig. 4), and heated in some way or other. The carburetting liquid enters at the end E of the tube, or in the upper part of the double bottomed vessel, and leaves at the other end E^1 as vapour, which is thence conducted by the shortest way to the gas to be carburetted.

Gasholders.—Dempster, J., of Newton Heath, Manchester. No. 18,047; Sept. 22, 1894.

This invention relates to improvements in the fixing of the spiral rails for guiding and supporting gasholders without upper guide-framing, in accordance with the Gadd and Mason principle—patent No. 13,521 of 1887.



The present inventor proposes to construct the holder at those parts where it is intended to attach the guide-rails, with plates placed diagonally or spirally, in lieu of vertically or horizontally; such spiral plates being riveted to the adjacent ordinary plates of the holder. The diagonal or spiral plates are, by preference, of greater thickness than the plates forming the main body of the holder, so as to afford greater strength at those parts where the strain of guidance and support is applied, without increasing the weight of the structure to an undesirable extent. The spiral plates are also, preferentially, of considerable length in proportion to their width; and, in some cases, one such plate might extend from top to bottom of the lift of a holder. Thus, overlapping joints, and consequent rivet heads, at these portions are obviated; and the guide-rail is brought into close and continual contact with the plate to which it is attached.

An illustration is given of part of a holder, with spiral rail and rail-plates according to these improvements, and a cross section of such rail and plates on a larger scale.

A are the ordinary plates of the holder. B are the diagonal or spiral plates, attached to the plates A by rivets, or otherwise, and jointed in any convenient manner. Or it may be formed in one length, and without such joint. C is a spiral guide-rail, connected by any convenient means to the plates B. D is an ordinary upright stay or stiffening rail.

Strengthening Incandescent Gas-Light Mantles.—Blücher, H., of Berlin. No. 18,309; Sept. 27, 1894.

This invention, relating to the mantles employed in incandescent gas-lights, has for its objects "to render such mantles stronger, more durable, and more elastic." The mantles which have already been prepared by any of the known methods, are placed in a concentrated alcoholic solution of shellac, to which is added any of the following: Magnesium silicate, magnesium chloride, hydrated silicic acid. The mantles, being removed from the solution, are dried while being held, in their proper form, in a Bunsen burner flame, which frees them from all organic matters. They are then preferably again subjected to treatment with the alcoholic solution, and again dried. The materials already mentioned as being added to the shellac solution may, if desired, be substituted by aluminium silicate, the double silicate of magnesium and aluminium, or silicate of potassium.

The first treatment of the mantles by the alcoholic solution and its contained additional ingredients may, if desired, be combined with, or form part of, the treatment or impregnation by which the mantles receive their power of becoming incandescent; and the second treatment takes place after the mantles have been incinerated or burnt.

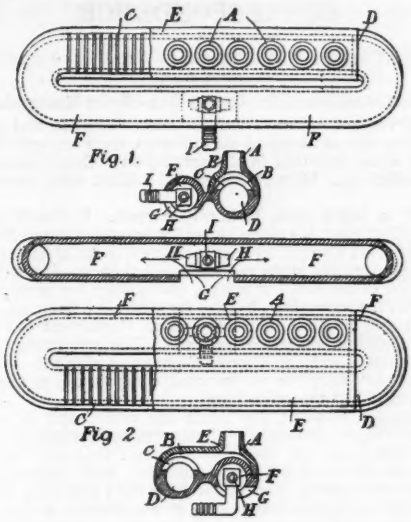
Atmospheric Gas-Burners.—Fletcher, T., and Russell, W., of Warrington. No. 18,896; Oct. 5, 1894.

This invention relates to burners used in gas-fires; and its objects are "to prevent lighting-back, and to avoid the explosions which sometimes occur in lighting and extinguishing the flame." Below the burner-nozzles is a safety chamber, separated from the mixing tube or chamber by a diaphragm, in which are formed slits for the passage of the mixed gas and air into the chamber below the nozzles.

Fig. 1 is a plan with part of the burner cap removed (in order to show the slits below); also a cross section and a vertical longitudinal section taken along the axis of the injection-tubes. Fig. 2 represents a modification in construction.

The gas-burner nozzles are at A; B is the safety chamber below the nozzles; and C is the slit diaphragm or partition, situated between the safety chamber B and the mixing chamber D. As already mentioned, the partition or diaphragm has slits in it for the passage of the mixed gas and air from the mixing chamber to the safety chamber. In fig. 1 the slits are saw-cuts made in the upper surface of the mixing-tube D; and the nozzle-cap E being semi-circular, the safety chamber B is crescent-shaped in cross section. But this is not essential; being the result only of the most convenient method of construction. The saw-cuts or slits are preferably $\frac{1}{16}$ inch wide or less; and the nozzle-cap may be secured above them, to form the safety chamber, by screws or other convenient means.

The modified form of the burner represented by fig. 2 differs only in



having the burner-nozzles arranged above the injection-tube. As in the other construction, the slits are formed in the upper surface of the mixing-tube D. But the nozzle-cap E extends over both the injection and mixing tubes; and a larger chamber B is thus formed than in the other form. This arrangement may be used when it is desired to prevent dirt falling through the burner nozzles upon the slits in C.

In other respects, the burners are constructed in the customary manner. In the burners represented, F are co-axial injection-tubes opening into the opposite ends of the mixing tube or chamber D, and having an air-inlet G below the gas-jets H, which are supplied through the pipe-nozzle I.

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21,781.—Quadling, G., "Heating pipes and coils with petroleum oil or gas." Nov. 12.

21,816.—Camp, F. de, "Furnaces heated with coal dust." Nov. 12.

21,829.—Abel, C. D., "Working gas or oil motor engines operating with slow combustion." A communication from the Gas Motoren Fabrik Deutz. Nov. 12.

21,936.—Bel, J. E. A., "Water-meters." Nov. 13.

22,034.—Schon, H., "Manufacture of coke." Nov. 14.

22,050.—Cooke, R., "Exhausting steam, foul air, and gases." Nov. 14.

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22,173.—Mobberley, T., "Arrangement and setting of retorts in their beds." Nov. 16.

22,183.—Gearing, E. G., "Gas-lamps and material for use therein." Nov. 16.

22,184.—Pinkney, C. W., "Manufacture of gas from liquid hydrocarbons." Nov. 16.

22,207.—Lake, H. H., "Manufacture of ammonia and bye-products." A communication from C. Pieper and C. Fellner. Nov. 16.

22,217.—Alexander, W., and Thompson, W. E., "Gas and fluid meters and coin-freed mechanism applicable thereto." Nov. 17.

22,231.—Fletcher, T., Russell, W., and Messrs. Fletcher, Russell, and Co., Ltd., "Atmospheric gas-burners." Nov. 17.

17,771A.—Felton, W., "Producing and burning gas to heat furnaces." Nov. 21 (date claimed, Sept. 18).

22,389.—Kirkman, J., "Joint rings and tape for securing pipe-joints, manhole-lids, and similar joints." Nov. 20.

22,410.—Settle, T., "Valves for relieving the pressure on gas or other retorts." Nov. 20.

22,457.—Sutherland, A. G., Stidder, J. G., and Everett, J. F., "Prepayment gas-meters." Nov. 20.

22,472.—Natanson, E., "Analyzing gases." Nov. 20.

22,495.—Barwise, S., "Lead pipes or tubes for conveying water or other liquids." Nov. 21.

22,500.—Clerk, D., and Lanchester, F. W., "Gas and like engines." Nov. 21.

22,521.—Orling, A., "Electric gas-lighters." Nov. 21.

22,565.—Lonholdt, F., "Gas-stoves." Nov. 21.

22,615.—Denayrouze, L., "Illumination by means of combustible gas with forced supply produced by electrical energy." Nov. 22.

22,644.—Love, J., "Saving and economizing the mantles used for incandescent lighting." Nov. 23.

22,658.—Wallis, W. H., "Automatic balance gas-burner." Nov. 23.

22,721.—Alexander, T., "Pilot gas-jet burner for the incandescent burner." Nov. 23.

22,830.—Glover, R. T. and J. G., "Coin-freed apparatus for the sale of gas in fixed quantities." Nov. 24.

22,850.—Braidwood, J. F., "An adjustable catch and cross-bar attachment for retort mouthpieces and other purposes." Nov. 26.

22,917.—Brock, J., Wareing, A. E., and Hurter, F., "Treatment of the residual solutions of the ammonia-soda process, and in the recovery therefrom of ammonia and chlorine." Nov. 26.

22,918.—Grant, T. B., "Gas or electrically-heated iron." Nov. 26.

22,946.—Clerk, D., and Lanchester, F. W., "Gas and like engines." Nov. 27.

22,983.—Wright, G. E., "Burners for gas-stoves and gas-fires." Nov. 27.

23,028.—Robinson, M. H., "Gas and vapour engines." Nov. 27.

23,142.—Sykes, T., "Utilizing heat from gas, oil, and other lamps, for warming carriages, rooms, or other enclosed places, and for ventilating same." Nov. 29.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Combinations of Traders in Gas-Works Materials.

Sir,—My respect for the *Newcastle Daily Chronicle*, and regard for its proprietor, almost tempted me to depart from my rule by writing to correct some mistakes in the article, on "Combinations among Traders," which you have reproduced. I must now, however, deal with it.

The title, to begin with, is hardly correct. It should have been "Screwing-Up," not "Screwing Down" prices; and to say that this and other London Gas Companies "have resorted to the identical practice" I condemn, and "have made gas making a close monopoly," is a misrepresentation of the fact. It is true, gas making is a monopoly. It is not, however, the companies, but the force of circumstances, that have made it so; and for more than forty years, Parliament has refused to permit competition, on public grounds. The amalgamation of the Surrey Consumers and the Phœnix Companies with this Company in 1879-80 did not destroy the unrestricted competition, as stated in the article; for that had ceased in 1853.

In this matter, however, my hands are clean, and my conscience clear. The "close monopoly" of the gas companies was a serious evil; for, with their full dividends secured, they had no adequate motive to do their best for the consumers. And although they did better for the consumers than might have been expected, the result—common to all such monopolies—was so unsatisfactory that gas agitations were constantly recurring. It was this consideration that led me to suggest the sliding-scale—a scheme (as I said in 1874) "that should cause the interests of gas companies and their customers to run side by side; to make the consumers in a sense partners in the gas company." This being adopted, has given the adequate motive that was previously wanting to serve the consumers well.

If the traders who supply gas companies had, in some such way, considered the interests of their customers as well as their own, my letter on the subject would not have been written. I did not know that "the gas companies are accused of being great adepts at sweating;" in fact, I cannot understand how the word applies, unless the writer means that asking for tenders in fair competition, and accepting the lowest, is "sweating." He also takes me to task for raising the question of honesty, and retorts that "gas managers are not impeccable;" mentioning Salford, which is rather unfair because it may unjustly prejudice an honest man.

But whether gas managers are impeccable or not, is no justification for such dishonest—I use the term advisedly—dealing as that reported, of the ring of gasholder builders, of whom I have heard something more since my former letter was written; and I think, as nothing whatever has been said by them, it may fairly be concluded that they have no answer to the statement. I was then unwilling to believe that they add a large amount to the estimates, and divide the plunder between them. If that is not dishonesty, I do not know what is.

It is known that, so long ago as the time for tendering for our first large holder, a meeting of gasholder builders, who were going to send in tenders, was held at the Westminster Palace Hotel, when the price was agreed; and I believe it was arranged who should have the work. This nice arrangement failed, because they left out one firm, then in financial difficulties; thinking that firm would be unable to do the work, and that we would not entrust it to them. We, however, accepted that firm's tender, and saved over £5000. In 1891, a certain gas company required a large holder. Before the time for tendering, a certain firm told the engineer they could do the work for £16,500. But when the tenders came in, their price was £24,150. None of the tenders was accepted; but the work was given to an outside firm, and so the money was saved. But gas companies are not always so fortunate. These conspirators do not pay their secretary—I hear £1000 a year—for nothing. I hear also that amounts varying from £3000 to £8000 have been added to tenders, and then divided between the parties tendering. I can hardly even now bring myself to believe that responsible firms can have thus acted. But I can assure them it is commonly believed, and the sooner they clear themselves—by dissolving their combination, and tendering for gasholder work at a fair price per ton—the better; and orders should be withheld until this is done.

I have not the slightest reason to suppose that the meter makers, or any other of the combinations of traders, have adopted the "knock-out" system. As to the meter makers, I think that some good has already resulted. I was informed by one of the best firms that they intend to give the five years' guarantee with the slot meters; and, better than that, they expressed a willingness to consider their customers by making arrangements for an annual revision of the price of meters, in order to give gas companies the advantage of any cheapening of the cost of manufacture. I find, however, that to some of their customers the meter makers reduced the discount after they combined.

I think the above suggestion a good one. It can, I think, be worked on the lines adopted by the iron trade for regulating wages. In this case an independent accountant certifies, from an inspection of books, what was the realized price of iron for the previous quarter, and says whether wages are to be increased or reduced, or to remain unaltered. In this case, of course, there are associations representing the iron masters and the workmen. In the case of the meter makers, while they have an association, the gas companies and corporations owning gas-works have none. But that is not an insuperable difficulty. The Incorporated Institution of Gas Engineers—being free from traders—is just the independent body for the work. But, if the Incorporated Gas Institute would free themselves from traders (as I should think these combinations would make them desire) they, being the oldest and largest body, might fairly claim the position; or, better still, the two might unite, and thus form a thoroughly representative body for the entire kingdom.

A number of the fire-brick manufacturers, as mentioned in Mr. Hunt's letter (*ante*, p. 980) have also been bitten by the combination fever; but I think that Mr. Hunt's letter has done good for some of us at least. I hear they have agreed that the combination shall not apply to London; and this is corroborated by some tenders I have seen lately, in which there is practically no increase of prices over those of last year.

I wish to live and let live. If the traders generally will act honestly and fairly, there is very little doubt that they and the gas companies will get along very well; but now that it is generally known that these combinations exist, it rests with them to take the necessary steps to preserve the connection.

George Livesey.

South Metropolitan Gas Company, Dec. 8, 1894.

The Extension of Stoking Machinery at the Birmingham Gas-Works.

Sir,—Having read the article, in your last issue, on the saving effected by the adoption of stoking machinery at Birmingham, I think you might (if only out of courtesy) have named the pioneers who have been the chief means of enabling the Corporation of Birmingham to produce such excellent results at their Saltley Gas-Works, and at the same time to have been more accurate in your statements.

If you refer to the Committee's report on p. 1076 of the same issue, you will find that your editorial remarks do not accord with the statements of the Committee, an extract from which is as follows: "It states, in the first place, that the Committee have authorized the expenditure of £5955, in the widening of the retort-house at Swan Village, and introducing certain alterations in the method of charging and drawing upon the principles adopted at Saltley, whereby a saving of at least 1s. per ton of coal carbonized has been effected, the whole of the cost of such work to be chargeable to revenue. When the reconstruction of the house is completed, the sum of £4350 will have to be expended in the provision of new stoking machinery. The report continues: The Committee, having regard to the great advantages which have followed the introduction of stoking machinery at Saltley, have been desirous for some time past to see these advantages extended to the whole of the Windsor Street retort-house. They have arrived at the opinion that at present stoking and charging by machinery is the more economical process of carbonization in long retorts, and, moreover, that it affords greater relief to the workmen."

It may be interesting to your readers to know that the whole of the stoking machinery at the Saltley Gas-Works has been in operation for several years, working upon 978 mouthpieces. This was erected by West's Gas Improvement Company, Limited, on their compressed-air system, which has produced the excellent results obtained at the Saltley works, and has convinced the Committee of the necessity of improving their Windsor Street works by the adoption of more stoking machinery.

Your article also states that an order has been given for the Arrol-Foulis hydraulic system for the Swan Village station. I must again refer you to the Committee's report, where you will find it says that the principle adopted at this station will be the same as at Saltley.

John West.

Manchester, Dec. 6, 1894.

[We regret that the ambiguity of the references in the Gas Committee's report to their decision in regard to the matters now fully explained in this letter led us into the mistake of which Mr. West complains; and we gladly take this opportunity of congratulating West's Gas Improvement Company, Limited, on their successes in Birmingham.—Ed. J. G. L.]

Unaccounted-for Gas.

Sir,—I have previously shown (see Journal for Oct. 30) that the loss of water from consumers' wet meters indicates that there is an important rise of temperature during the passage of the gas from the street-mains to its point of measurement, immediately prior to consumption. Excluding errors, if any, in the registrations of the gas-meters, it will be found that a study of the alterations in the volume of the gas due to differences of temperature and pressure, either artificial or atmospheric, leads one to the conclusion that, at least in ordinary cases, the bulk of the gas unaccounted for is not to be explained by such differences of temperature and pressure; and therefore, unless some other mode by which the gas can disappear from the distribution system be found, it must be classed as actual leakage.

The influence of the differences of artificial pressure alluded to by Mr. Tysoe in the Journal for Nov. 27 militates against the case that unaccounted-for gas is not mainly leakage. I may here mention that this important factor, as affecting the volume, was fully dealt with in an article, on "Leakage," published in the "Gas Engineer's Text-Book of 1888;" and was referred to in my more recent article (*ante*, p. 821). It has been the practice for years in many gas-works to make allowance for the heavy artificial pressure under which the gas is measured in the station meters.

I will consider the case of 100 volumes of gas registered on the station meter as being delivered at the consumer's meter without loss; but only changed in volume by being submitted to other conditions of temperature and pressure taken from actual practice—

100 volumes of gas registered on the station-meter index at average barometric pressure of 29·93′, average temperature of 57° Fahr., and average artificial pressure of 8 inches water, become when measured at 30′ bar. and 60° ther., and no artificial pressure,

102·55 volumes.

The same quantity of gas measured at 30′ bar. and 17-10ths artificial pressure (average pressure in consumers' meters) and at the average temperature of the earth—viz., 46·4° Fahr., becomes

98·8 volumes.

But the temperature of the gas in the consumers' meters must be higher than the earth temperature. The lowest results I obtained by the water-evaporation method were from the 10-light meters. These give an average temperature of 52° Fahr.; and if that had been the temperature, then the volume would have been (had there been no loss by leakage) 100·1 volumes, against 100 volumes registered by the station meters.

From the water-evaporation results obtained, it would appear, however, that the temperature was higher than 52° Fahr.

I believe a consideration of these facts leads but to one conclusion.

1, *Victoria Street, S.W., Dec.* 6, 1894. LEWIS T. WRIGHT.

Gas-Fires for Bedrooms.

SIR,—Your correspondent, Mr. Marsh, is quite mistaken in stating that the apparatus we referred to is his. We should, and do, know better than to publicly condemn an apparatus which has been privately submitted to us. The arrangement referred to is one which was submitted to us, and was under consideration, at the same time as Mr. Marsh's. We selected it in preference, because it had no microscopic holes and valves to be interfered with by specks of dust, and had no leather or perishable material about it; and although we decided not to offer it for sale for the reasons given, we shall be in a position to supply if the demand arises.

FLETCHER, RUSSELL, AND CO., LIMITED.

Warrington, Dec. 6, 1894.

The Meter System v. Inspection for Detecting Waste of Water.

SIR,—Replying to "London" in the JOURNAL for Aug. 21 last, I have fixed a waste-meter on a section of a district with a pressure of 200-feet head of water. We have a 9-inch main 7500 yards long, with 5-inch branches to the side streets. All the service-pipes are lead. There has been no night inspection made for six weeks. There are 756 houses; and the exact population is 4515 (ascertained by inspection and estimating every house).

We read all the meter supplies, and deducted the amount of consumption from the waste-line of the diagram, and we have a waste of 4 gallons per head per day. To check this result, we shut off all the meters for six hours; and the waste-line then stood the same—the diagram showing no leakage. As a further check, we have divided the district by shutting off the side streets; and we found the trunk main perfectly tight—the diagram again showing no leakage. We stethoscoped this district six weeks ago, and found it tight. The diagram does *not* show where to find a leak; and I conclude that the 4 gallons per head per day waste is from a large number of *small* leaks, so minute that they cannot be traced by sounding.

It is stated by Mr. Collins that it is not necessary to inspect for waste, if the waste-line does not exceed 8 gallons per head per day. This diagram simply proves that the night inspector has sounded all services, main cocks, and hydrants; and it also proves that my assertion is correct—viz., that a night inspector with a sensitive stethoscope cannot pass over a leak.

This district of 4515 population consumes for domestic purposes 18 gallons of water per head per day, including waste.

Dec. 6, 1894. WASTE INSPECTOR.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, Dec. 3.

(*Before Justices* GRANTHAM *and* LAWRANCE.)

The Commercial Gas Company v. The London County Council and Williamson.

This was a motion on behalf of the Commercial Gas Company for a rule *nisi* for a *certiorari* calling upon the London County Council and Dr. Alexander W. Williamson, the Chief Gas Examiner for the Metropolis, to show cause why a determination and report by him should not be brought up and quashed on the ground that it was made without jurisdiction, in consequence of its having been made on hearing the evidence of only one party, in the absence of the other, contrary to the statute.

Mr. A. T. LAWRENCE, in support of the motion, stated that the question arose under the Commercial Gas Act, 1875, and the Amendment Act of 1880. By the former Act, provision was made for the appointment of Gas Referees, and also of gas examiners. The Referees had power to prescribe the various tests to which the gas was to be subjected, and to determine the several matters to be used in those tests. They also had power to specify the place at which the test should be made. Then at each station there were to be examiners to test the gas; and if one of these reported the gas to be defective, either in illuminating power or in any other respect, he was to report to this effect. Then the Gas Company had power to appeal against this to the Chief Gas Examiner, whose report was made conclusive evidence before the Justices on application being made for the penalty. The interpretation section of the Act provided that the word "candles" should mean "sperm candles of six to the pound, burning 120 grains an hour each." Section 25 provided that a copy of each certificate of the Gas Referees should be sent to the Metropolitan Board of Works (whose successors were the County Council) and to the Commercial Gas Company. Section 32 enacted that the Gas Referees should from time to time prescribe the number and situation of the testing-places, as well as "the apparatus and materials to be used therein for testing the illuminating power, purity, and pressure of the gas" to be provided by the Company; and the Company were to "provide and maintain such testing-places and apparatus and materials accordingly." Section 33 set forth that the prescribed testing places and apparatus provided by the Company should be under the control and management of the Metropolitan authority. The learned Counsel went on to say that trouble had arisen between the London County Council and the Company as to the "materials" to be used for testing the gas; and the Referees were called upon to "prescribe" the materials in the shape of candles. In December, 1893, they did so in an elaborate specification,* which described the wicks to be used, and the manner in which they were to be made. It was found very difficult to produce candles made in accordance with the specification; and the Company were unable to procure them. In this state of affairs, in April last the examiner at the Wellclose Square testing-place made a test with some old candles, which had been sent in some time previously to the issue of the specification, and in regard to which the Company had been informed that they were not suitable, and would not be used in testing. Having used these candles, the examiner reported that the illuminating power of the gas was deficient; and against this report there was an appeal to the Chief Gas Examiner. On the 3rd of May, another examination was made at the Parnell Road testing-station, where the candles were supplied by the London County Council. In that case also the gas was reported to be deficient in illuminating power; and an appeal was made. Both of the appeals came on together for hearing before the Chief Gas Examiner; and he determined and reported against the Company in each case. But the Company declined to enter into the merits of the question, and informed Dr. Williamson that they desired to raise two legal points, in order that the procedure might be brought into conformity with the statute. These points were, first, with regard to the Wellclose Square case, that the candles not being in accordance with the specification then in force, and having, in fact, been previously rejected, were not "candles" within the meaning of the Act, or (as required by the Act) candles prescribed by the Gas Referees; and, secondly, in respect to the Parnell Road case, that the candles were not the prescribed ones, nor supplied by the Company, but were provided by the County Council. The Chief Gas Examiner, having heard the parties, seemed to have obtained further evidence from the officials of the Council, and then to have made his determination against the Company; and the point of view he appeared to have gone upon was that, inasmuch as the Company had not provided candles at the time, the deficiency with regard to the candles was a ground for finding the report against the gas right.

Justice GRANTHAM: I suppose the Act makes the decision of the Chief Gas Examiner final and absolute.

Mr. LAWRENCE said this was so, as far as the question of fact went; and it was conclusive evidence before the Magistrate, who was the authority for enforcing the penalties. There had been some laxity in regard to this matter before 1893. Previously, apparently by consent, the candles had been provided by the Metropolitan Board of Works. But the London County Council were reforming things, as they said, and had introduced a different candle from the old one; and this had caused some "friction" between the parties. The Council thereupon required the Gas Referees to prescribe a candle; and they had done so by the specification of December, 1893. This had subsequently been found to be an unworkable prescription; and it was withdrawn in June, 1894. It was while this prescription was operative that the matters in question arose.

Justice GRANTHAM: Surely, whatever happened has been settled and done with; and it is hardly worth while, if this particular prescription of the Gas Referees has been done away with, to go on with the matter.

Mr. LAWRENCE: It is not that, my Lord; but proceedings have been taken by the County Council in those two cases for enforcing the penalties. The penalties specified in section 14 of the Act of 1880 are: For the first half candle the gas is deficient in illuminating power, a penalty of 40s.; and for the first and every subsequent candle of defective power, a penalty of not less than £20, and not exceeding £100, having regard to the relative quantities of gas manufactured by the respective companies. So that we may be fined from 40s. to £100. I do not know exactly how much we were reported to be deficient. The learned Counsel went on to say that the case was important not only in these particular instances, but because the gas companies wanted a decision of the Court upon the question whether they were entitled, before these penalties could be enforced against them, to have the provisions of the Act observed. The Chief Gas Examiner had really sought to find that the Company were in default in providing candles, although they could not get the candles; and he had held them responsible because a particular form of candle was prescribed. The making of such candles being difficult, the Company could not purchase them. The various authorities had used other candles; and the Chief Gas Examiner made this a ground for convicting the Company of the offence. The Company urged that he could not do this, because he was only to determine whether the illuminating power of the gas on the day in question was or was not defective.

Justice LAWRANCE: What is the meaning of this recital in the specification of the Gas Referees? "Whereas the Chief Gas Examiner has disallowed a return of the illuminating power of the gas on the ground that 'candles of different manufacture, possibly of different illuminating power, from those usually employed in the testing-places, and which had not been prescribed nor certified by the Gas Referees, were employed in the tests against which the Company have appealed.'"

Mr. LAWRENCE: That refers to some old dispute. I say that in that case the Chief Gas Examiner disallowed the return; and he ought to have done so in our case, because the candles used were not those prescribed here. I do not, however, found my case on that previous decision, but on the Act. When the appeal came on, the Company went to the Chief Gas Examiner, and said they would not go into the merits of the case, but took the two preliminary legal points as to the candles being according to the specification and provided by the Company. The whole protection the Company can have is that they should provide the candles. It is important, where there is considerable nicety involved, that the Company, by providing the candles, should tie their hands, as it were, against objections on the score of the candles being wrong.

Justice GRANTHAM: I see the Chief Gas Examiner does not agree with you. He says, in his report, that it appeared in the Wellclose Square case that the candles employed were contained in packets stamped and supplied by the Company.

Mr. LAWRENCE: Yes, my Lord; those were old candles. A prescription having been made in 1893, they went back on some candles which had been supplied before, and rejected as not proper.

Justice GRANTHAM: As to the Parnell Road case, the report states: "It appears, from letters they put in, that the Company were informed

* See JOURNAL, Vol. LXII., p. 1133.

by the Council, on the 28th of April, that candles as prescribed by the Referees were obtainable for certification by the Referees, and for supply by the Company to the testing-places. The Company did not, however, think proper to provide the candles."

Mr. LAWRENCE: That is not the fact. That was all the result of a hearing that he had of certain of the Council's officials behind our backs. The letter of the 28th does not say, in so many words, what the Chief Gas Examiner construes it to say. It says that candles certified by the Referees are obtainable. My affidavit shows that the Referees say that, in certifying those candles, they never intended to say they were proper candles for the purpose of the legal test for imposing penalties. Their certificate was not, as I understand, a certificate that these candles were in accordance with their prescription. They are in the habit of certifying, as authorities on the subject, various things for uses other than these legal tests. For instance, they certify burners and other things that are taken away for use in the country as burners certified by the London Gas Referees. I have not a copy of the certificate. It is not immaterial to remember that the Act provides that all certificates issued should be sent to the Company; and we had no copy of any such certificate. This corroborates what they have told the Company's Manager, Mr. Jones, since—that the candles were never intended to be certified for the purpose of this legal test to enforce penalties. In the Examiner's report, he states that we did not send the candles, and that there is no provision in the Act for our failure to do so; so he has been good enough to make one.

Justice GRANTHAM: It seems to me that there are a great number of complications in this case, and apparently, as appears from the report of the Chief Gas Examiner, the statute has left out something. The direction in the statute is not complete; and therefore he has chosen to determine—whether rightly or wrongly it is not for us to say at the present time—what is to be done in the absence of a full direction. He admits the difficulty; and he has thought himself in a position to determine how to get over it. Under these circumstances, I think you are entitled to your rule.

A Dispute as to a Water Supply for Trade Purposes at Sevenoaks.—At the Sevenoaks Police Court last Friday week, the Misses Bligh and Mr. J. S. Bligh were summoned by the Water Company for the following offences: (1) For permitting water to be used for other than domestic purposes; (2) for unlawfully suffering a pipe to be connected to the Company's main, so that their water was misused; and (3) for fixing to the service-pipe a pipe for the conduct of water, without having previously obtained the sanction of the Company. In stating the case for the Company, Mr. Warner said the proceedings were taken under the Water-Works Clauses Act, 1863. It appeared that defendants had three separate supplies of water—viz., to a brewery, which was gauged by meter, to an hotel, and to a farm, the two latter supplies being paid for according to the rateable value of the property. In consequence of information which was conveyed to the Company's Manager (Mr. F. Hunter), he visited the hotel in June last; and there, in a scullery at the back of the house, he found that a dairy had been started, with two creamers erected over the sink. On the top of the sink, a flexible pipe was fixed, from which water was running; and on a service-pipe on another part of the scullery wall, a second flexible tube was placed. The water from these tubes was used for the purposes of the dairy; and this was done on premises which were simply served by an ordinary supply. The Company tested by meter the loss of water in the dairy; and from June 6 to July 31, no less than 77,900 gallons of water were used, or 1442½ gallons per day. This, at 2s. per 1000 gallons, would work out at £1 0s. 2½d. a week. Subsequently the dairy was discontinued; and from Aug. 4 to Nov. 24, the meter registered a consumption of 316 gallons per day. The rateable value of the property in question was £70 per year; and the Company, therefore, with baths, &c., received £5 15s. per annum for the water supply. Taking the consumption which they found was going on in June and July, they would have been entitled to something like £53 per annum. In defence, Mr. Cripps stated that there was an existing agreement between the Company and Mr. Bligh for the supply of water for trade purposes. In 1889 the dairy in question was being carried on; and water was supplied by means of pipes in the scullery before mentioned. After the first supply had been given, which was charged for in respect of the demand note of June 24, 1889, the creamers referred to were put in. The charge was immediately increased from 10s. to £3 for the half year. This price was disputed by Mr. Bligh; and the case was brought before the County Court Judge, who assessed the fair value of the supply at 30s., instead of £3. In January, 1893, the Company still supplied water to the dairy, and were doing so now; the only dispute being as to price. In January of last year, Mr. Hunter sent in a bill for water supplied, and stated that the account for the supply to the creamers would be forwarded afterwards. It had not yet been sent in; but when it was, it would be paid, if the charge were a reasonable one. But the fact that no account had been sent in did not terminate the contract. The Justices were unanimously of opinion that all the summonses must be dismissed with costs, and that the charges of fraud were not by any means proved.

Morley Water-Works Extensions.—The Morley Town Council have adopted a recommendation of the Water Committee, that application be made to the Local Government Board for leave to borrow £27,000 for completing the Withens reservoir, &c., and £15,000 for purchasing land and constructing a service reservoir at Bruntcliffe; the loan to be extended over a period of 60 years.

Gas-Meter Rents at Nottingham.—Replying to an inquiry by Mr. Gregory at the meeting of the Nottingham Corporation yesterday week, as to whether the Gas Committee were going to report to the Council on the subject of gas-meter rents, Alderman Ford stated that the Committee had no feeling whatever in the matter; but it would make a difference of about £6000 to the town, and would, of course, affect the rates. There were now in use some 1800 penny-in-the-slot meters; and he thought that this to some extent met the case. So far as the Gas Committee were concerned, it was simply a question of considering the Finance Committee.

MISCELLANEOUS NEWS.

BIRMINGHAM CORPORATION GAS SUPPLY.

The Reduction in Price—The Committee's Report—Cost of the Change in the Conditions of Employment at the Works.

At the Meeting of the Birmingham City Council last Tuesday—the MAYOR (Mr. Alderman Fallows) presiding—the report of the Gas Committee (the chief features of which were noticed last week) was under consideration.

Alderman POLLACK first proposed—"That the Gas Committee be and that they are hereby authorized and instructed to reduce the price of gas to private consumers by 3d. per 1000 cubic feet, and for public lighting in proportion, from the next quarterly reading of the meters." In the course of his remarks, he said it was just twelve months since it was his unpleasant duty to ask the Council to increase the price of gas by 3d. per 1000 cubic feet. As to the reasons which led the Committee to take this step, he pointed out that for several years past, they had had to meet a vastly increased expenditure caused by the higher cost of coal, wages, and improved purification—amounting to £115,500; and all they had to set against it was an additional revenue from residuals, which amounted to £6500, leaving an increased annual expense of £109,000, as compared with 1886. The prices of gas had not been changed since 1886. In addition to these drawbacks, the consumption of gas had remained stationary in the year ended March, 1893; and, instead of recovering, it showed a decline, resulting, at the end of the last financial year, in a reduction of the consumption by 2 per cent. The Committee, however, hesitated to raise the price of gas; but at length came the great coal strike, and this proved the "last straw." The cost of additional coal bought during the strike over and above the contract price was £24,000, in addition to the higher working expenses caused by having to deal with a quality of coal yielding less gas and requiring more purification—expenses which could not have been less than £5000. These sums had to be provided for; but had they stood alone, and had they not been preceded by two adverse years, it was probable the Committee would have hesitated to ask the Council to disturb the prices of gas fixed in 1886. However, the additional burden left them no alternative. It was true that subsequently, at the end of the strike, they were able—thanks to a suggestion made by their Secretary—to re-sell a portion of the dear coal at the pit's mouth; and thus reduce the extra cost from £24,000 to £15,000—a difference which had benefited the profit and loss account of the last financial year. When the prices were raised, he stated that the Committee were anxious not to maintain them at the higher rate a day longer than was found necessary. Having had the experience of the trading of the last six or seven months, they were now better able to estimate the results of the present financial year, and to make a forecast of the future. Since then the contracts for coal had been entered into for the year ending June, 1895. Although the quantity of coal offered was large, the prices were very stiff; and the Committee were only able to obtain a very small reduction—hardly exceeding 2d. per ton all round—off the prices of the previous year. The subsequent reduction in the wages of the miners had been anticipated in fixing these prices. But, small as it was, the saving was a favourable item in this year's trading. As to residuals, they had obtained a small advance in prices on their tar contract; and the improved revenue from ammoniacal liquor had been maintained up to the end of September. Since then unfortunately there had been a gradual fall in the price of sulphate of ammonia, which no doubt would unfavourably affect the revenue of the present and next quarters. This would also be the case with respect to coke, owing partly to the reduction of prices that had just taken place. There had been a large increase of rates and taxes; but the improvement in manufacture would more than balance this additional burden. The most pleasing item had been the increased sale of gas, notwithstanding the higher price. The increase during the last six months of the financial year had been 6 per cent., which was large, particularly when compared with the state of things during the preceding two years—there having been stagnation in one year, and actually a reduction of 2 per cent. in the next. The Committee had some considerable doubt whether it would not have been more prudent, in the face of the permanent increase in wages and other items of expenditure, and the possibility of a decline in residuals, to have made the reduction in price 2d. instead of 3d. The reasons which influenced them in 1892 and 1893 in raising the charge were as valid now as they were then; but, on the whole, the circumstances were more favourable. As to the reductions in other localities, he had a list of twenty-one towns in which reductions had taken place during 1894; but these reductions meant the taking off, not, as in Birmingham, of a first advance, but of a second advance—the reductions in themselves being very small. In seventeen of these towns, the present reduced prices were actually higher than the existing increased average prices in Birmingham. In the other four cases, there was a difference of 1d. in favour of these localities; but, on the other hand, they charged for meter-rent, while Birmingham did not. The prices in Birmingham would now be 2s. 7d., 2s. 5d., and 2s. 3d. per 1000 cubic feet for private, and 1s. 1d. for public lighting—all subject to a discount of 5 per cent.; the average, calculated upon the consumption at different prices, being 2s. 2¼d., free of meter-rent. Except for gas undertakings favoured by special circumstances, these prices would be found to be the lowest in the kingdom.

The proposition, having been seconded, was carried unanimously.

Alderman POLLACK then moved the adoption of the report in its entirety. In doing so, he remarked that the Committee had been very active in introducing improvements at the works, with a view to greater economy in manufacture. It was hopeless to expect that they would ever again buy coal at the low prices paid before 1889, especially as the higher railway rates seemed likely to be maintained; and the Companies declined to restore the rebates formerly given. Some further reduction—though a small one—in the cost of coal, however, might take place next year. In retorts and retort materials, a ring formed among the manufacturers had tried to raise the prices 70 to 100 per cent. The Committee had had to submit to this, but had not

allowed the manufacturers to have it all their own way. As to the prepayment meters, they were doing all they could to secure for the system a fair trial. With regard to the inconvenience experienced by ratepayers in the suburban districts in having to come to the central office to pay their accounts, arrangements had been made with Mr. Wight, the Postmaster, for accounts in certain suburbs to be paid at the respective post offices. Regarding the sale of coke, they had not only reduced the prices, but had placed consumers who were able themselves to arrange for cartage from the works on the best town terms; no distinction being now made in favour of dealers, though the difference in price to large purchasers would still enable the dealers to compete with the department in selling coke in small quantities. Referring to a return as to the numbers of the workmen employed on twelve and eight hour shifts respectively, Alderman Pollack said that the additional amount of wages paid by the department on the average of the two years following, as compared with the two years preceding, the change in the conditions of employment represented 1¼d. per 1000 cubic feet on the gas produced; making a total of £21,480. The number of eight-hour shift men had been increased by about 50 per cent.; the maximum number employed during the winter months having risen from 810 in 1887 to 1362 in the year ended March, 1892. Allowing for the increase of 15 per cent. in the production of gas, the additional number of men might be put at 430. The extra cost of wages, however, was not confined to the eight-hour shift men. The other workmen had had proportionate benefits conferred upon them, either by a reduction in the hours of labour or by an advance in wages; and the number of such men had also been increased, though in a smaller proportion. The additional amount of wages paid from the latter part of 1889, when the changes first came into operation, to the end of March, 1893, averaged per annum, after allowing for the increased production—to eight-hour shift men £24,333, and to other workmen £9784, or £34,117 per annum. The increase in the first item was mainly due to the larger number of men employed, and not to higher wages—the principal gain of the men being shorter hours. The total maximum number of men employed at all the works had risen from 1342 in 1888 to 2074 in March, 1893; and the minimum or summer number during the same period, from 683 to 1097. These alterations, involving so large an increase of working expenses—made with the full assent of the members of the Council, and he believed of the ratepayers of the city, and he need hardly add with the concurrence of the members of the Gas Committee—had given general satisfaction to the men. He would, however, point out that an increase of wages of £34,000 per annum was more than equivalent to an increase of 2d. per 1000 cubic feet on the price of gas; and that in reverting, notwithstanding this permanent increase in their expenses, to the former price of gas, the Committee had solved the problem of "eating the cake and having it." (Laughter.) In conclusion, Alderman Pollack said that the increase of 6 per cent. in the consumption of gas appeared to be large; but, inasmuch as the average annual increase since the transfer had been 4 per cent., and during the last two years there had been a reduction of 2 per cent., instead of an aggregate increase of 8 per cent., the 6 per cent. should be compared with 14 per cent.—the equivalent of the former average increase of consumption during three years. Such an increase, however, was hopeless now, as he explained last May. One reason was the introduction of the improved incandescent burners. Not only did this burner yield a vastly higher illuminating power, but the consumption of gas was hardly one-half that required for an ordinary flat-flame burner. The light, too, was absolutely steady; and the heat and products of combustion were considerably reduced. He ventured to say that this light was infinitely superior to the electric light; while its cost was hardly one-third, probably not one-fourth, of that of electricity. He trusted that the conductors of all large institutions, and especially of those fostered by the Council, would think twice before satisfying the craze for electric lighting, when they had at their command a light equally good, if not superior, supplied from their own works at one-fourth the cost.

The report was unanimously approved.

ROTHERHAM CORPORATION GAS SUPPLY.

Results of the Working of the Department.

On the minutes of the Gas Committee being introduced for confirmation at the meeting of the Rotherham Town Council last Wednesday, Mr. Bryant drew attention to the half-yearly financial statement of the department. The gross profit, he said, was £1061—less the estimated proportion of annual loan charges, £2506; and public lighting transfer gas (proportion), £548. These two items made a total of £3054; leaving an approximate net loss of £1993. He thought this was a very serious deficiency. If they took the items for repairs, work, and tools, it was more than the whole of the wages. Of course, there had been reasons given as to how this had been brought about; and he asked the question, in order that the Chairman of the Committee might have a chance of explaining the matter. Mr. Gummer, the present Chairman (interposing), said he was not responsible. Mr. Bryant admitted that was so; but he supposed Major Stoddart would speak on the subject. In his (Mr. Bryant's) opinion, the ratepayers would be rather uneasy about so large a deficiency accruing at the gas-works. The Mayor (Alderman T. Woodhouse) thought that Mr. Bryant had acted fairly in putting the question. He said that there had been many erroneous statements made respecting the management of the gas-works; and it was advisable that the information should be given to the public. There was a reason for the deficiency; and the Chairman of the Committee would doubtless make a satisfactory reply. Mr. Stoddart pointed out that the financial statement dealt with the two quarters of the year when the expenditure was the greatest, and the income was the least. There were the establishment charges, salaries, rates and taxes, and the bulk of the repairs, whereas there was only one-third of the output of gas in the six months. He argued, therefore, that £1000 of the £3054 should not rank against the six months under consideration; and the same applied to rates and taxes and other items. The bulk of retorts were in use in the winter; therefore the repairs were done in the summer months. With regard to the future, that was the first time they had had an approximate revenue account; and they would be able next year to make comparisons. Taking into consideration the higher price they were getting for residuals, and the less cost of coal, they ought to do considerably better this year than they did last. Mr. Hirst expressed an opinion that whenever inquiries were made as to the losses incurred at the gas-works, it was always attributed to something unfortunate. He thought the time had arrived when they should get out statistics as to the profit or the loss at other gas-works, and see how the Rotherham works compared, and let them have no more apologies in the lame, half-hearted manner of Mr. Stoddart. Mr. Stoddart: I did not apologize; I simply stated facts. Mr. Hirst: They are deplorable facts. Alderman Neill remarked that he did not look upon the statement as satisfactory. He thought the loss was far too large to be made up during the next six months in order to make a good profit. The minutes were adopted.

NEWCASTLE-UNDER-LYME GAS-WORKS.

Reflections on the Management.

There was a somewhat acrimonious discussion at the meeting of the Newcastle-under-Lyme Town Council last Tuesday, on the question of the management of the gas-works. The minutes submitted by the Gas Committee stated that they had instructed the Town Clerk to take the necessary proceedings to recover the amount in default by the late tax collector from his sureties. In moving the adoption of the minutes, Alderman Briggs, the Chairman of the Committee, said they had waited very patiently for the annual balance-sheet of the department; but as this was not yet forthcoming, they had decided to call in a professional accountant (Mr. P. H. Pope), with the object of securing an immediate balance-sheet for the past year. Mr. R. Ratcliffe then complained of the way in which the Committee had been managed. He said he had had two letters from the Local Government Board on the matter; and he was pleased to tell the members that an inquiry would be made into the way in which this huge concern had been conducted. The books, he said, were not in a satisfactory condition; and the way in which things were carried on at the gas-works was a public scandal. The Mayor (Mr. C. H. Hardeman) suggested that it would be better to await the report of Mr. Pope. Mr. Ratcliffe said he was going to move that Mr. Pope did not appear on the scene at all. The books were kept in such a "rascally form" that they were not creditable to any corporation. He asked the Borough Acountant and Auditor of the Gas Department accounts, whether he had got the balance-sheet. Mr. Fenton said it was very nearly done; but he could not finish it until he had received certain figures from the Gas Engineer (Mr. W. Winstanley). After further discussion, Mr. Ratcliffe inquired if the reason for the gas accounts not being in the abstract of the Corporation accounts was because they were not satisfactory. Mr. Fenton replied that it was not. Mr. Ratcliffe asserted that the undertaking did not pay 2½ per cent. on the outlay; and the whole thing was a complete farce. They wanted a Government accountant to go through these accounts for the last ten years. He alleged that the money was going into the wrong channel. Mr. Brownfield observed that, as Mr. Ratcliffe was a member of the Gas Committee, if there was anything radically wrong as he said, he ought to have put his hand upon it. Mr. Ratcliffe said he had done so long since. Alderman Briggs entered into a lengthy explanation; and Alderman Hyslop suggested the appointment of a Sub-Committee, and he thought that they should employ a gentleman from a distance to audit the accounts. Mr. Ratcliffe moved an amendment to this effect, which Mr. Brownfield seconded; the latter remarking that, as far as he was concerned, he believed that everything was fair and honourable. Mr. Ratcliffe showed the letters he had received from the Local Government Board, upon which Alderman Briggs said he did not care twopence for the Board; they were there to manage their own affairs. After a long discussion, the amendment was put and carried by a large majority. Alderman Briggs at once rose and tendered his resignation as Chairman of the Gas Committee; and said he should consider whether he should not leave the Council. He was prepared to accept defeat; but he protested against men voting one way in Committee and another way in the Council. Alderman Mellard thought the charges ought to be strictly investigated; and Mr. Ratcliffe expressed the hope that Alderman Briggs would reconsider his decision. A Sub-Committee was formed; Alderman Briggs declining to serve.

Fatal Gas Explosion at West Bromwich.—A serious explosion of gas, which was unhappily attended by loss of life, occurred at the works of Messrs. Salter and Co., spring-balance manufacturers, West Bromwich, on last Thursday week. A storekeeper, named Samuel Morton (age 50), and Kate Johnson, a japanner, sustained shocking injuries; and the former succumbed a few minutes after his admittance to the District Hospital. The Coroner (Mr. E. Hooper) held his inquiry yesterday week. After the medical testimony, Elizabeth Darby, who worked in the same department as Kate Johnson, gave evidence which disclosed the cause of the explosion. She stated that their duties were to black lamp bottoms, and put them in a stove to dry. Gas was supplied to the stove for the purpose of heating it; the taps being below the floor. The lamp bottoms were placed on a carriage, which was run into the stove. On the day of the accident, deceased went into the shop, and said he could smell gas. He turned it off; and, on opening the door of the stove, there was a loud explosion. The Manager of the works (Mr. J. Hughes) expressed his opinion that the gas in the stove was turned on, and not lighted; and when the door was opened, the gas rushed out and exploded. Similar stoves had been at work for 20 years without accident. It was possible to put the carriage in without lighting the gas; but it would only be done through great carelessness. The jury returned a verdict of "Accidental death."

JOHANNESBURG LIGHTING COMPANY, LIMITED.

As mentioned in the JOURNAL last week, a meeting of this Company was held in London on the 29th ult., for the purpose of sanctioning—subject to some arrangement being come to with the preference shareholders—the transfer of the undertaking to the Johannesburg Sanitary Board. Mr. W. Garland Soper, J.P., presided. After giving a brief account of the previous history of the Company, he laid before the meeting the present position, which may be summarized as follows: That the Company bade fair to become a success, provided sufficient capital had been forthcoming; that the shareholders had not been able to provide the necessary further capital; that, in view of the imperative necessity of further extensions in Johannesburg, things could not possibly remain as at present; and that a sale of the undertaking to the Sanitary Board appeared to be the only solution. Accordingly, authority had been given to Sir J. Sivewright to negotiate; with the result that the Sanitary Board had agreed to purchase the Company's undertaking, &c., for £160,000. This amount would give to the debenture-holders and to the preference shareholders their capital in full; and to the ordinary shareholders about 5s. per share, provided the preference shareholders would forego any cumulative dividend that might have accrued. It was pointed out that, if the sale were not completed, preference shareholders might not have the opportunity again of receiving the offer of their capital in full; and that, under the terms of the concession, the Sanitary Board might harass the Company. Mr. Crisp then explained the terms of the provisional agreement; and, in the course of the discussion which ensued, each preference shareholder present having consented to waive the whole of the cumulative dividend, signatures were appended to an agreement to this effect. The Chairman then moved the following resolution: "That the Board be and they are hereby authorized to enter into an agreement with the Sanitary Board of Johannesburg for the sale of the Company's undertaking, on the terms of the draft agreement laid before the meeting, or with such modification as the Directors may approve, but subject to an arrangement satisfactory to the Board being made with the preference shareholders to forego all interest, if any, payable on their shares." Mr. A. Jones seconded the motion; and it was carried unanimously. The thanks of the meeting were then accorded to the preference shareholders for consenting to forego any dividend payable on their shares, and to the Chairman for presiding; and the proceedings then closed.

ELECTRIC LIGHTING NOTES.

When the minutes of the Electric Lighting Committee were before the Belfast Corporation last Saturday week, Mr. Harrison reminded Alderman Pirie that six months ago he told the Corporation that the citizens would have the electric light about November. It was not available yet; and he wished to know when it was likely to be. Alderman Pirie replied that it would probably be January before the Committee would be in a position to furnish electricity; and, for the information of another member, he added that applications had been received for the light equal to about one-fourth of the capacity of the undertaking. In the report presented by the Gas Committee at this meeting, was the announcement that they had "made an additional grant of £500 to the Library Committee and £5000 to the Electric Committee for the purposes of these respective departments."

The Brighton Town Council last Thursday adopted a recommendation of the Lighting Committee, to the effect that the electric light works should be extended at a cost of £42,900. Speaking in support of the recommendation, the Chairman of the Committee (Mr. Stafford) quoted some interesting figures, which we will notice next week.

An instructive letter regarding the relative cost of street lighting by electricity and gas was placed before the Canterbury Town Council at their meeting last Wednesday. The writer was Mr. A. J. Lawson, of the Canterbury Electricity Supply Company, Limited; and he proposed to the Corporation that they should light the principal streets by means of 47 arc lamps, which were to displace 129 gas-lamps. The price he suggested charging for the arc lamps, burning all night long throughout the year, was £30 each; or if the lights were extinguished at midnight, £25 each per annum, provided a 14 years' contract were entered into between the Corporation and the Company. Taking the total number of gas-lamps to be replaced as 129, their average illuminating power as being about 12 candles, and the price charged to the Corporation as being £3 13s. 6d. per lamp from sunset to sunrise the whole year round, the cost of gas lighting would, he said, be £474 1s. 6d., *plus* the additional cost of the large Sugg or Bray burners—say, £30—making the total probably about £500; while the cost of current for the 47 arc lamps would be £1410—or "about 26 times the volume of light for less than three times the outlay for gas lighting." Mr. Lawson trusted that the information he had placed before the Council would enable them to favourably consider the question of entering into a contract with his Company. However, apart from the fact that the Corporation Inspector had reported to the Electric Lighting Committee that Canterbury was not a suitable city for the electric light, the members, according to the account of the proceedings at last Wednesday's meeting which we have received, appeared to be unanimous in thinking that they should not entertain such an outlay as the electric light would entail. It was therefore agreed to postpone the question for six months; and it was hinted that, in the meantime, the Gas Company would be asked to see what could be done in the way of lighting the streets by incandescent gas-lights.

Mr. W. J. B. Clerke attended at the Chester Town Hall last Wednesday to inquire into an application by the Corporation for the sanction of the Local Government Board to the borrowing of £25,000 for their proposed electric lighting installation, and to the appropriation of a portion of the Tower Field Gardens (which belong to the Corporation) as a site for the generating-station. In the course of an explanatory statement, the Town Clerk (Mr. S. Smith) said that the estimate furnished by Dr. Hopkinson for the first installation, including contingencies and engineering expenses, was £19,697; and therefore was within the vote of the Council. If, however, street lighting was included, and if, in the course of the development of the works, the demand arose in the first year or two, Dr. Hopkinson thought they might have to spend £25,150. Mr. J. M. Frost, as a representative of one of the largest ratepaying firms in the city, while not opposed to the electric light, objected to the Corporation raising money for the purpose. He did not think the city, as a whole, wanted the light; but from this opinion the Mayor (Mr. W. H. Churton) dissented. He (the Mayor) believed that, if a poll were taken, it would be found that 99 per cent. would go in for the electric light. Perhaps small cottagers would not; but the people who used, or resided in, the principal streets would, more especially as the gas had been very bad for some time.

The Harrow Local Board have for some months had before them a project for the establishment of an electricity supply station for the public and private lighting of the town; and the matter was entrusted to a Committee. The Board's Engineer (Mr. W. C. C. Hawtayne) prepared an estimate of working expenses for a scheme to supply 4440 10-candle power lamps, and he made it £2092; his total estimate for the installation amounting to £9300. Tenders were invited, and several were submitted. These were examined by the Committee, with the assistance of Mr. Hawtayne; and, with one exception, they were all below that gentleman's estimate. His figures in regard to working cost were sharply criticized at a ratepayers' meeting, where it was stated that they were £900 less than they should be. It was also objected that he had made inadequate provision for payments of the instalments of, and the interest on, the capital expenditure, as well as for depreciation. A further objection was raised that his statement that electricity at 8d. per unit was equivalent to gas at 4s. per 1000 cubic feet, and would therefore be cheaper than gas at 4s. 6d. (the price at Harrow), was altogether too low; while his estimate that a 10-candle lamp would consume, on an average, 18 units per annum was excessive, and consequently considerably affected his calculation as to the profits. Another matter which was questioned was the lighting of the School buildings. The cost of this with electricity worked out to £360 per annum, whereas the actual gas bill comes to only about £140. The lighting of the streets by means of incandescent lamps was also objected to. These several points have been fully dealt with in a long report which the Committee have presented to the Local Board, in which they recommend a tender submitted by Messrs. Crompton and Co., Limited, as suitable. Their figure comes to £8139, to which will have to be added about £1000 for trenching and transformers; making the total £9139, as compared with Mr. Hawtayne's estimate of £9300. Their tender for working the lighting varies with the number of units consumed annually, and ranges from 6·4d. to 3·15d. per unit. Mr. Hawtayne reckoned that, when all the lamps were taken up, there would be an output of about 115,000 units; and his estimate for working expenses was at the rate of 4¼d. per unit. Messrs. Crompton and Co. furnish figures for the yearly working of the station according to the number of lamps estimated for by Mr. Hawtayne. Assuming that the private and school lighting will take 65,400 units, they put the revenue from these, at 8d. per unit, at £2180; for the street lighting, they put down £550 (the credit price paid for gas lighting); for meter-rents they charge £20—making a total of £2750. Against this they place the working cost, which they guarantee shall not exceed, for the above-named output, £1736, or, with £100 for office and collecting expenses added, £1836; showing a balance of £914. Deducting from this £720 for repayment of instalments and interest on the capital expenditure (6 per cent. on, say, £12,000), there is shown a yearly profit of £194, as compared with £161 estimated by Mr. Hawtayne. The Committee say that, as this gentleman's figures have been confirmed by the experience of working in large and small towns and the actual tenders received, they think it would be a misfortune if the lighting of Harrow by electricity were to pass out of the Board's hands. They consider that, if they worked the station themselves, they would be able to allow discount for prompt payment, and at no distant date to reduce the price.

Last Saturday week, the Morecambe Electric Lighting Company appeared before the Magistrates sitting at Lancaster Castle to answer the complaint made against them by the Local Board respecting the nuisance from their works, which it was averred was injurious to health. The works are situated in the centre of the town; and in the generation of the electricity, they use as motive power engines driven by Dowson gas, in the manufacture of which the smells complained of were caused. The alleged offence was spoken to by a number of lodging-house keepers who live in the vicinity, and who stated that they had not only suffered in health, but had lost numbers of lodgers during the season through the noxious smells which came into their houses from the defendants' works. The Medical Officer characterized the nuisance as one injurious to health. On behalf of the Company, it was urged that the gas manufactured was passed through tanks of water. The tainted water was turned into the main sewer; and the sewer traps of the houses, being defective, allowed the smell to come from the sewer. The Magistrates imposed a fine of £1 and costs; and the Company undertook to abate the nuisance.

Answering an inquiry by Alderman Dickins, at last Wednesday's meeting of the Salford Town Council, Mr. Holland, the Chairman of the Gas Committee, said the inhabitants need not expect to have the electric light this winter, as the contractors appeared to be hopelessly behind their time. The Committee had decided to sell the electricity at 7d. per unit, which was 1d. less than was charged in Manchester.

Proposed Improvement of the Portrush Water-Works.—The Portrush Water and Sanitary Committee have received from Mr. A. D. Williamson, of Coleraine, a report on the improvement of their water supply. He recommends alterations and repairs in the reservoirs and filtering arrangements, and the provision of better means for collecting the water; and he calculates the cost of accomplishing his proposals at £1625. It may be remembered that, a few weeks ago, Mr. L. L. Macassey submitted a project for procuring an auxiliary supply of water for the town, at an outlay of £4800; but the Committee, while admitting that the scheme is an excellent one, have come to the conclusion that it would involve a much larger expenditure than it is advisable at present to incur.

STOCKTON AND MIDDLESBROUGH WATER BOARD.

The New Supply Available.

The last connecting link of the main which is to convey by gravitation a pure supply of water to Middlesbrough, Stockton, and Thornaby, was completed on Monday last week; and water will now be delivered from a point above all source of suspicion of pollution. The Water Board became possessed of the old Water Company's property on July 1, 1878. The sum paid for it (which was settled by arbitration) was £802,956; the proportion of interest in the concern being Middlesbrough one-half, Stockton five-twelfths, and Thornaby one-twelfth. At that time the supply was derived from the River Tees at the Broken Scar pumping-station, situated two miles to the west of Darlington, and immediately above the intake of the Darlington Corporation Water-Works. Both are below the sources of considerable sewage contamination, notably at Barnard Castle; and the Stockton and Middlesbrough Water Board applied for, and obtained, parliamentary powers for the construction of works for the supply of water from a point above suspicion of impurity. After meeting many difficulties, it was found necessary to ask for an extension of the time limitation, which was granted. The first portion of the scheme was the construction of the Hury reservoir in the valley of the Balder. The work, which consists of a huge embankment across the whole valley, was commenced in 1884, and was practically completed about eighteen months ago. The Contractors were Messrs. W. Scott and Sons, of Newcastle; and the cost was roughly £199,000, exclusive of land. The scheme also includes the Blackton reservoir, about two miles above Hury, in the same valley, and the Grassholm reservoir, which will have to be connected by means of a tunnel through the intervening hills with the other portions of the undertaking. Blackton reservoir is now in course of construction; but the Grassholm reservoir will only be commenced when there is a prospective need for the additional resources which it will afford. The scheme also required the laying of a gravitation main to the point where the old pipes commenced; and this, as stated, was completed last week. Up to the present, the total cost of the undertaking amounts to £1,696,813. In view of the serious charges which have been laid to the old water supply as being the cause of various epidemics in the past, general satisfaction will be felt by the consumers that the new supply is now at their command.

THE WORKS OF THE COLNE VALLEY WATER COMPANY.

The members of the Incorporated Association of Municipal and County Engineers recently held their autumn meeting at Bushey, for the purpose of inspecting the Colne Valley Water Company's works, the following description of which was given on the occasion by Mr. Brough Taylor, M.Inst.C.E.

The works supply a district extending over 75 square miles, most of which lies in Hertfordshire; the smaller portion being in Middlesex. This area reaches from the boundaries of two of the London Water Companies up to the districts of Watford and St. Albans. The average supply is about a million gallons daily; the population at present supplied being something like 45,000. The water is obtained from wells in the chalk formation; the stratum being found at the surface in the neighbourhood, and having a thickness of about 690 feet. The first well, which now forms the engine-well, was sunk in 1874. It is stated to have yielded about 820,000 gallons in 24 hours when first pumped out; but the yield gradually decreased to 600,000 gallons. In 1881, it was determined to increase the available quantity of water; and, with this end in view, a second well and deep boring were sunk and connected with the engine-well by an adit below the line of saturation, so that the overflow from the new well should run by gravitation to the old one. The second well is 43 feet deep and 7 feet in diameter. From this depth a borehole, 18 inches in diameter, was sunk to a depth of 477 feet; being then reduced to 15 inches diameter, and continued for a further depth of 180 feet through the chalk marl, ultimately reaching the gault at 700 feet from the surface. The quantity of water which this second well is stated to have contributed is 635,000 gallons per 24 hours; making, with that obtained from the engine-well, about 1,235,000 gallons per day.

When Messrs. Taylor, Sons, and Santo Crimp were first called in to advise the Directors of the Company, they found the above-named figure represented not the average, but rather the maximum yield from the wells—the minimum at that time being scarcely a million gallons per day; and as the period of minimum yield in chalk wells occurs about the time of the maximum demand of the district, it was soon found necessary to increase the yield by new works. The objects his firm had in view were (1) to lower the engine-well, so as to enable them to get the suctions of their pumps farther down below the line of saturation; (2) to cut the deep boring at the lowest possible level, in order to liberate the water which would undoubtedly issue when the top pressure was removed; and (3) to form a new pump-well, in which at any future time additional pumping power could be placed. These works were carried out by Messrs. T. Docwra and Son; and the result has been to give the Company three times as much water as they had before—the available minimum supply being now well over 3 million gallons per diem; and the operations were carried on without any interruption of either the softening process or the supply to the district.

The pumping-engine was designed by Mr. Taylor's firm in 1889, and was set to work in 1891, since which time it has performed all the pumping. It is one of the compound beam type, with upper and lower lift-pumps and surface condenser. The Lambert trip-gear is introduced into the engine. The lower pump is furnished with a bucket at the bottom and a plunger at the pump-head; and the upper pump is of the combined bucket and plunger type. The lower lift raises the water from the pump-well, and discharges it into the softening-tanks; and the higher lift draws from these tanks, and delivers its water through the pumping-main to the reservoir. The pump horse power of the engine when running 16 revolutions per minute is 133; and at this speed it discharges 1,400,000 gallons in 24 hours. The steam is obtained from one or other of two Lancashire boilers, 30 feet long and 7 feet in diameter, steaming at about 80 lbs. pressure.

In reference to the process of softening the water before sending it out for use, Mr. Taylor said his partner, Mr. Midgley Taylor, had contributed the following account of the process, and the works required for carrying it on: "Rain water falling upon the earth has in it practically no dissolved solid matter, and is perfectly soft; but it contains varying proportions of dissolved gases, including carbonic acid, which the rain has absorbed from the atmosphere. In percolating through the strata down to the underground natural reservoirs, the water dissolves, and carries with it any soluble matter with which it may come in contact; and, owing to the presence of the carbonic acid gas, it is capable of dissolving carbonate of lime or chalk, which would otherwise be practically insoluble. These various dissolved matters cause the hardness of water. It is apparent, therefore, that the dissolved salts causing hardness may be divided into two classes—(1) those which are soluble in water by themselves; and (2) those which are held in solution by the aid of the dissolved carbonic acid. The salts in the first class cause what is called permanent hardness; those in the second, temporary hardness, or that which can be removed by the expulsion of the carbonic acid, as in boiling, or by its absorption, as in softening. The chief salts which have a hardening effect upon water are the carbonates of lime and magnesia, causing temporary hardness, and sulphates of lime and magnesia, causing permanent hardness. I shall only refer to the former salts causing temporary hardness, as that is all that can be removed by the softening process. The softening here is effected in the usual manner by adding lime water to the hard water. In 16 oz. of chalk, there are about 9 oz. of lime and 7 oz. of carbonic acid; and by burning the chalk, the carbonic acid is driven off—leaving the 9 oz. of lime, which may be dissolved in not less than 40 gallons of soft water. This solution is called lime water. An average sample of chalk water is presented by 16 oz. of chalk held in solution by 7 oz. of carbonic acid dissolved in 400 gallons of water. Now, when the solution of 40 gallons of lime water containing the 9 oz. of lime is mixed with the 400 gallons of chalk water containing 16 oz. of chalk and 7 oz. of carbonic acid, the 9 oz. of lime will combine with the 7 oz. of carbonic acid, forming 16 oz. of carbonate of lime or chalk. This, being insoluble, precipitates; and the carbonic acid being thus absorbed, the 16 oz. of chalk, previously held in solution, is likewise precipitated. The resultant, therefore, is 2 lbs. of precipitated chalk in 440 gallons of softened water. The process therefore consists of a very simple chemical reaction, and one that is easily adapted for dealing with large volumes of water. The plant at these works comprises a small tank with stirrer, where the slaked lime is reduced with water to about the consistency of cream; two lime-water tanks for dissolving the cream of lime to form lime water; and a range of settling-tanks, where the reaction and deposit take place. The cream of lime from the mixer is run into the bottom of one of the lime-water tanks, which is then filled with soft water, thoroughly agitated, and allowed to settle. The lime water thus made is then decanted into one of the settling-tanks, when about ten times its volume of hard water is pumped in. The mixture is then left until complete settlement has taken place, when the clear softened water is pumped away to supply. We find that with three settling-tanks the pumping, both of the hard water into the tanks and the soft water therefrom, may be carried on continuously. Each tank-full of soft water is tested with nitrate of silver, to ascertain that the whole of the lime has been neutralized; and the degree to which the softening has been carried is estimated clearly. It may be stated roughly that the relative cost of softening water by lime, carbonate of soda, and soap respectively is: Lime, 1s.; soda, 20s.; soap, £20. Apart, however, from the commercial aspect of the case, and speaking generally, it must be conceded by sanitarians that water treated in this way is distinctly improved in quality, and is, therefore, safer for dietetic purposes."

At the close of Mr. Taylor's description of the works, which are in charge of Mr. J. Blackburn, Assoc.M.Inst.C.E., an inspection was made of the station.

THE SAND FILTRATION OF WATER AT LAWRENCE (MASS.).

At the Meeting of the American Public Health Association in September last, a paper on the above subject, having special reference to the results obtained at Lawrence (Mass.), was read by Mr. G. W. Fuller, the Biologist in charge of the Experimental Stations of the Massachusetts State Board of Health. The filtration process carried on at Lawrence having been already noticed in our columns, the following extracts from the paper may be of interest.

At the annual meeting of this Association at Chicago last year, I had the honour of presenting to you some of the results of the investigation upon water purification made by the State Board of Health of Massachusetts. It was then shown that all disease-producing bacteria in the Merrimac River at Lawrence may be removed by slow intermittent filtration through fine sand and loam. But this is not all that the filter accomplished in the removal of bacteria. Out of 102 analyses, 58 indicated that the filtered water was absolutely sterile. Furthermore, the few bacteria which were found in the effluent from time to time belonged to the most hardy species of water bacteria, many of which existed in the form of spores, and which, let it be understood, are not killed by the ordinary application of heat or of chemicals.

Spring water obtained from favourable sources has repeatedly been found to be absolutely sterile, the result of natural filtration. This is Nature's method of purifying water; and the efficiency of natural filtration may be attributed to the retention of the bacteria within the filter under an unfavourable environment. The natural consequence of these conditions is the survival of the fittest bacteria. Now, the evidence at hand shows that the disease-producing bacteria are among the first to succumb, because they are farthest removed from their natural *habitat*. The non-pathogenic bacteria eventually perish also; but, unlike the case with the dangerous species, this does not happen until they have established a home and breeding-place within the filter.

Under the most favourable conditions, filtration may be conducted so that no bacteria pass through with the filtered water. This can only be done under circumstances where the discharge from the filter is sufficiently removed, by time and distance, from the main seat of bacterial activity.

We know that there are a score or more of germs which may produce specific diseases in mankind. There are many more species which are of the utmost benefit to the human race. They accomplish their work by decomposing and nitrifying processes, and convert objectionable organic matter and disease germs to harmless mineral matter. The benefit to mankind of the saprophytic bacteria cannot be over-estimated. In no place in Nature are the opportunities for bacterial activity more favourable than in filters. We find that the purification of water with the removal of disease-producing germs by filtration is Nature's method. We may go a step farther, and state that in the purification of water that method is safest which follows most closely Nature's method, and which is least dependent on human agencies.

Nature's method of filtration means the intermittent application of water to sand or soil in rates equal to the rainfall. The economic adoption of sand filtration, particularly as it has been practised successfully for many decades in Europe, differs from Nature's method, strictly speaking, in that the rate of filtration is much higher, and the surface of the sand or soil is covered with water for long periods of time. The essential underlying principles, however, are the same, because the results are produced by bacterial activity which permanently exists in all filtering materials.

While the removal of pathogenic bacteria by chemicals, including coagulants, and by heat, will for ever be directly dependent on human attention and judgment, I venture to predict that the day will come when the knowledge of filtration among sanitary scientists will be such that filters may be constructed and operated by which water free from objectional bacteria will be supplied to hundreds of thousands of citizens, and require the attention of a mere handful of men. Even under these circumstances, the opportunity for exercising personal attention and judgment can be reduced to very narrow limits. In order to obtain this desirable end, it is necessary to study thoroughly the laws of filtration from engineering, bacteriological, chemical, and hygienic points of view.

For the past seven years, the State Board of Health of Massachusetts have been studying the laws of filtration at the Lawrence Experimental Station. In a certain sense, the Lawrence work may be regarded as investigations upon Nature's ways of working, with a view to their more economical and advantageous application to the problems in actual practice. The results of these investigations have been published from time to time in the actual reports of the Board. It is fitting on this occasion that I should review some of the more important points upon the filtration of water contained in the annual report of the Board for the year 1893.

In the operation of a filter, one of the important points is the rate at which water passes through the filtering material. As a result of European experience, the conventional limit has been set at from 2 to 3 million gallons per acre daily. Recent results obtained at Lawrence show that the Merrimac River water may be filtered through proper materials at rates of 4, 6, and even 8 million gallons per acre daily, with practically no diminution in the bacterial efficiency. Further investigations are necessary to show whether filters may work at this rate for an indefinite time without a period of absolute rest. The maximum rate of filtration allowable depends upon the quality of the water and the quality and quantity of the sand. The advantage of higher rates of filtration with undiminished hygienic efficiency is apparent, because it means reduced size and cost of filtering plant.

It is well worth noting that, in the operation of water-filters, a greater hygienic efficiency is obtained from uniform than from fluctuating rates of filtration. The disadvantage of fluctuating rates has been demonstrated in the case of some of the older water-filters in Europe. From the Lawrence work, it appears that with filtering materials of increasing degrees of coarseness, and with higher rates of filtration, the advantage of uniform rates becomes more marked.

Concerning the depth of material, it has been found that, while very satisfactory results may be obtained, under favourable conditions, from filters 1 to 2 feet deep, the deeper 5-feet filters are safer. The investigations indicate that, within the limits in sizes of sand grains which would be usually employed in filtration, the finer sands are ordinarily slightly more efficient in removing bacteria than the coarser ones.

It has been stated that an objection to sand filtration of water is that the hygienic efficiency is materially reduced during the period which immediately follows the scraping of the surface to relieve clogging. In the light of recent Lawrence results, this period of somewhat diminished efficiency appears to be largely due to mechanical disturbance of the main body of the filtering material during the process of refilling the filter with water after draining and scraping it. The effect of this mechanical disturbance, caused largely by escaping air, is to create places of lessened resistance to the passage of water through the filter, thereby allowing the water to pass through certain limited areas of the material at very high rates and under abnormal conditions of filtration. It has been found that there are reliable and practicable means of overcoming this difficulty. One method, for instance, is by slowly filling the filter from below after draining.

In regard to the application of water to filters, there are two methods —first, the continuous, by which the filters are continuously operated with the surface of the sand constantly covered with water; and, secondly, the intermittent, by which the water is from time to time shut off from the service for a certain period, and the water allowed to drain out of the sand, the pores of which fill with air. The advantage of intermittency is that it provides within the filtering material an additional amount of oxygen, with which the bacteria may perform their functions.

So far as the experimental filtration of the Merrimac River water at Lawrence is concerned, there is no marked difference in the average results which may be obtained by the two methods of application of water. The reason of this is that a practically sufficient quantity of free oxygen is held in the water as it flows on to the filters. In 1890, it was shown that a small amount of oxygen (1 to 3 per cent.) in the air of a sewage-filter was effective, provided that the air was changed so often that some oxygen was always present at every point. That continuous filters at Lawrence are supplied, under ordinary circumstances, with sufficient oxygen, is shown by the fact that it has never been found absent in the effluents as they pass from the filters through trapped outlets. This is confirmed by the results of long series of analyses of the effluents from both continuous and intermittent filters. Moreover, the analyses of the filtering materials themselves showed that the sand from intermittent filters contained substantially the same amount of organic matter as that from corresponding continuous filters.

To make clearer the interpretation of the investigations upon this point, let me state that the free dissolved oxygen in a water depends chiefly upon temperature and pressure. As there is practically no increased pressure upon water as it flows on to filters, the amount of free oxygen held in the water varies with the temperature, and, generally speaking, cannot exceed the point of saturation for the given temperature, even after aëration. The maximum quantity of free oxygen held in water varies from 1·47 parts at 32° Fahr. to 0·81 part at 80° Fahr., expressed by weight in parts per 100,000. Now, it will be seen that the quantity of free oxygen, which is absolutely essential to chemical and bacterial purification of water by sand filtration, cannot exceed a fixed quantity in different waters under parallel conditions of pressure and temperature; while the amount of organic matter in waters under the same conditions may increase within wide limits. The quantity of free oxygen within the filter, which will suffice for the complete purification of the water, must be in proportions corresponding to the organic matter. For this reason, it is clear that spring and other waters which contain relatively small proportions of organic matter can be filtered by the ordinary continuous method with complete success; while the filtration by this method of sewage, which contains a comparatively large quantity of organic matter, is an absolute failure. Intermediate between the two, in point of organic matter, a line must be drawn, below which either the continuous or the intermittent method of application of water to filters is allowable, but above which the intermittent method can alone be used with safety. Not only the quantity, but also the quality, of the organic matter must be taken into consideration; for it is well known that animal matter is more easily decomposed and mineralized than organic matter of vegetable origin.

With regard to the experience at Lawrence, it may be stated that during midsummer—the period of greatest bacterial activity within the filters, and also the time when the amount of free oxygen in the Merrimac River water is least—intermittent filters give somewhat better results. On the other hand, during midwinter, when the Merrimac River water is saturated with oxygen, the advantage appears to lie somewhat in favour of the continuous filters, because they are more protected from the effect of freezing weather.

In order to obtain the required amount of free oxygen, it is necessary in the case of some water, and absolutely essential in the case of sewage, to charge the pores of the filter with oxygen from time to time, because the quantity which can be applied in the water is limited by the point of saturation. Therefore the arbitrary adoption of the continuous or intermittent method of application in the filtration of a certain water is not advisable. It becomes a matter of adjustment of the necessary quantity of free oxygen within the filter to the amount and quality of the organic matter in the water under consideration.

We have now considered the way in which sand filtration does its work, and referred to some of the controlling factors in its operation. Let us next turn to the hygienic results obtained by filtration, and to their interpretations. At the Lawrence Experiment Station, during the year 1893, there were made more than 12,000 bacteriological analyses in repeatedly testing the efficiency of twenty individual filters of different construction and operation. The average results of these analyses indicated that 98·54 per cent. of the number of bacteria in the Merrimac River water were removed by filtration. This average includes all normal results, many of which were obtained from filters and under conditions which would not be recommended for adoption in practice. Under reasonably favourable conditions, the removal was from 99 to 99·5 per cent. of the number in the applied water. Of the average percentage (1·54) of bacteria which remained in the filtered water—in actual numbers 140, as compared with 9100 in the river water —a majority appear to belong to the most hardy forms of water bacteria. Furthermore, it has been learned that from 15 to 25 per cent. of these bacteria are present in the form of spores, which are not killed by the ordinary application of heat and of chemicals.

In studying the hygienic efficiency, we are not dependent alone on the results from these water species of bacteria. Billions of typhoid fever germs have been cultivated and applied to the filters. When these were put on to the filters in numbers corresponding to the water bacteria, under high rates of filtration, they passed through the filter into the effluent in very limited numbers. They were present in the filtered water, however, in relatively much smaller numbers than the common water bacteria. The average number of these germs, applied in pure culture to the filters, was 6000 per cubic centimetre, of which 99·81 per cent. were removed by the filters.

The reason why such large numbers of these specific bacteria were applied to the filters was to test the efficiency of filtration under different conditions, and to obtain numbers sufficiently great to show clearly the laws of filtration. It will be admitted by everyone that the tests upon the efficiency of the filters in removing these bacteria were far more severe than would ever occur in practice. Looking at the experiments more carefully, it is seen that these germs were applied to the filters for weeks, in numbers equal to those of the ordinary bacteria in the Merrimac River at Lawrence. At times, in fact, the numbers were a hundredfold greater. In order to appreciate more fully these experimental conditions, let me state that, in order to obtain, in actual practice, corresponding numbers of typhoid fever germs, it would be necessary to add to the drainage area of the Merrimac River, above Lawrence, a population sick with typhoid fever, equal in number to the present inhabitants. This statement assumes, of course, that there would be conditions corresponding to the present ones with regard to sedimentation, the effect of light, temperature, osmosis, &c. It may be very safely stated that the experimental

conditions at Lawrence are a hundredfold more severe than would ever occur in the filtration of an ordinary water supply. This shows what a large factor of safety lies behind the bacteriological investigations at the Lawrence Experiment Station, and furthermore may serve to explain the confidence with which those who are familiar with these investigations believe in hygienic efficiency of the sand filtration of water supplies.

The results from the filtration of water at Lawrence are no longer confined to the experimental stage. A filter to purify the water supply of the city has been for some months in successful operation. From an engineering point of view, this filter contains many important features. Briefly, it is 2·5 acres in area, and contains sand of an average depth of about 4·5 feet. The depth of sand varies from 3 to 5 feet; but, owing to the arrangement of the under-drains, all water passes through at least 5 feet of filtering material. The filter is situated by the side of the Merrimac River, and is separated from it by an embankment. Its surface is 2 feet below low water in the river. The water is allowed to flow on to the filter for about 16 hours a day on an average; and during the remainder of the time the sand is drained, and the pores are filled with air. The filtered water is conducted by under-drains to a collecting conduit, and thence to the pump-well. The pumps determine the rate of filtration, and are speeded so that the water shall pass through the filter at the rate of 2 million gallons per acre in 24 hours. From the pumps the water passes to the open distributing reservoir, which is 25 feet deep at high water, and contains 40 million gallons. The water then flows by gravity from the reservoir to the consumers.

From the time when the filter was put in operation (Sept. 20, 1893) until May 1, 1894, daily bacteriological analyses, in addition to numerous chemical analyses, were made of the water before and after its passage through the filter, as it leaves the reservoir, as well as from taps at the City Hall and the experiment station, which are distant 1¼ and 2½ miles respectively from the reservoir. The results were as follows:—

	Average Number of Bacteria per Cubic Centimetre.		Average Percentage Removed of Number Applied.
River	10,900	..	—
Effluent at filter	264	..	97·58
Water from reservoir outlet	139	..	98·73
Water from tap at City Hall	90	..	99·17
Water from tap at experiment station	82	..	99·25

The above averages include all results. Excluding those obtained under conditions which were abnormal and not likely to occur again, we find that this filter normally reduced the bacteria from 9000 to 150 per cubic centimetre—a removal of 98·3 per cent. of the number applied. Owing to the fact that some ground water of rather unsatisfactory quality with regard to numbers of bacteria was at times mixed with the effluent, it is improbable that all the bacteria in the water pumped to the reservoir passed through the filter.

During the five years preceding the use of the filter, the average annual death-rate from typhoid fever in Lawrence was 1·27 per 1000 inhabitants. The population of Lawrence is 50,000; and this average rate is equivalent to 63 actual deaths per annum. During the past year, there have been 26 deaths from typhoid fever—a reduction of 60 per cent. Furthermore, it has been learned that, of the 26 who died, 12 were operatives in the mills, each of whom was known to have drunk unfiltered and polluted canal water, which is used in the factories at the sinks for washing. Among the operatives of one of the largest corporations, where canal water is not used, there has not been a single case of typhoid fever during the past year. The test of the efficiency of the filter has been a fair one, because at Lowell, the sewerage of which enters the Merrimac River 9 miles above the intake of the Lawrence filter, there was during the winter of 1893-4 a severe epidemic of typhoid fever.

Sales of Shares.—Messrs. Pirie and Orr sold at Scarborough last Friday week, £300 of consolidated new 7½ per cent. stock in the *Scarborough Gas Company* at £158 per cent.; and an allotment of £40 (£32 paid) of ordinary 7 per cent. stock, at £53.——Messrs. Morris and Place, of Nottingham, last Wednesday, disposed of some *Nottingham Corporation Gas* annuities (ex-div.) at £102 2s. 6d.——On the following day at Mansfield, Mr. G. Cox offered for sale £200 of *Mansfield Corporation Gas* debenture stock, which was purchased for £224 10s.

Bursting of a Water-Main in Durham.—An extraordinary occurrence took place early on Sunday of last week a little to the north of Hunwick Station, near Bishop Auckland, on the North-Eastern Railway. At the point named, the line is pierced by a trunk main of the Weardale and Shildon Water Company, who supply a large part of the county with water that runs by gravitation from extensive moors in the north-western part of the county. The main in question had burst during the night; and so destructive had been the force, and so considerable the volume of escaping water, that the line was washed away, and practically left useless for traffic. Breakdown gangs were soon requisitioned; and the traffic was resumed in the evening.

Gas and Electric Lighting at Lancaster.—In proposing the adoption of the minutes of the Gas Committee at the last meeting of the Lancaster Town Council, the Chairman (Alderman Hatch) remarked that he was glad to be able to say the comparative statement of gas consumed during the past quarter was very much better than at the corresponding period of last year; and although they had not yet felt the pressure of the electric light, the Committee were exceedingly loyal to their consumers, and would endeavour to do the best they could for them by reducing the price of gas at the earliest opportunity. Not only were they trying to do this, but they were going to endeavour to meet the wants of the poorer inhabitants by the adoption of the penny-in-the-slot meter. Probably at their next meeting, this system would be adopted; and the matter would come before the Council in due course. Whether the Electric Lighting Committee would start anything of the kind, he did not know; but they would endeavour to set them a good example. As soon as the Electric Light Committee could afford to pay anything reasonable in the shape of a contribution towards the rates, the Gas Committee would not be backward in attempting to follow them (laughter).

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Falkirk Corporation have this week created a record in the matter of instituting litigations regarding the arbitration between them and the Falkirk Joint-Stock Gas Company. Hitherto their ambition to figure in the Law Courts has been gratified by the possession of one suit at a time; but over-indulgence in the excitement seems to have produced the usual result, and now their taste can only be satiated by having two going at once. The action for the reduction of Mr. Barr's appointment was served this week; and along with it there has also been raised another process of suspension and interdict, in the Bill Chamber. This is now the fourth interdict in connection with the arbitration. The Corporation have had to give way on all of them—the first two by compromise, and the last by direct defeat. They could have taken the last case to the House of Lords; but meantime that course is not entertained. Perhaps it would be interpreted as a manifest obstruction, and might injuriously affect their reductive action. The latest interdict is in precisely similar terms to the one which was thrown out last week. The reason for its being brought appears to be that they have now the action for reduction in Court, and that they will thus have a stronger plea for the postponement of the arbitration proceedings than they had when they were merely threatening to raise such an action. They might have asked for interdict in the action for reduction; but then the conclusion for interdict would not have been operative until a decision had been given in the case, which may be two or three months yet—long after the arbitration would have been over. There is thus good reason, from their point of view, for the re-institution of the proceedings for interdict. A strong effort will be made to obtain interim interdict, and so stop the arbitration until the reduction is disposed of, which will probably be in the House of Lords, perhaps somewhere about a year hence. Rumour has it that Mr. Ure, their senior Counsel hitherto, does not homologate their views, and that he has been replaced by Mr. A. Graham Murray, Q.C. This gives colour to the idea that they mean to be more vigorous this time. As against them there is, of course, the certainty that the Gas Company will strenuously resist the granting of interim interdict. Lord Low yesterday ordered the Company to lodge answers to the Corporation note; and it has been arranged that the case will be heard next week. The hearing can be little more than a formal affair, as it must consist largely of a restatement of the old arguments. Lord Low's decision may be looked for right off; and then there will be the recourse to the Inner House, as in the last case, which can be made to cover a little more time. Now a new element comes in. The arbitration has been fixed to begin on the 18th inst., which only gives a few days in which to proceed to the Inner House. Suppose Lord Low refuses interdict, the course would be clear for the arbitration to proceed; and so, if the Corporation should wish to take a decision of the Inner House, they would require to do it at once. But suppose they did elect to take the opinion of the Inner House, they could lodge their reclaiming note on the 17th; and, of course, in that case the arbitration could not proceed the following day. The cross-purposes are many; and the possibilities for their exercise are not few. Whatever the result may be, there is one effect of the postponement of the arbitration for (say) a year which the Corporation appear to be blind to. They seem to forget that they would thereby be giving the Gas Company another year of possession, in which they could either build up their works with new plant, and thus raise the price of the undertaking, or starve them, and so leave the Corporation at a disadvantage in taking the concern over. To one not behind the scenes, it would appear to be the best policy to get a speedy determination of the question at issue. This would be accomplished by allowing the arbitration to proceed; and then, if they felt aggrieved, they might have their remedy afterwards, in a reduction of the award. Possibly this will come after all. It is announced that Mr. Barr, meantime, does not intend to appear as a respondent. The projected meetings of citizens in opposition to the litigation is still in abeyance.

I am sorry to say that Mr. W. Ure, who was returned to the Glasgow Town Council, and has since been re-appointed Convener of the Gas and Electric Lighting Committee, has had a petition against his return presented to the Sheriff by Mr. George Mitchell, who opposed him in the election. Mr. Mitchell was a labour candidate; and he claims the seat, on the allegation that the majority of votes were in his favour, because mistakes were made in counting. The poll as declared, showed that 2193 voted for him, and 2573 for Mr. Ure; giving the latter a majority of 380. Whatever may be the merits of the case, it looks as if it would be difficult, in a recount, to remove so large a majority.

The Glasgow Gas and Electric Lighting Department are happy in their revenue this year. The gas-rental collected for the year to Nov. 28 amounts to £31,860—an increase upon the same period of last year of £3643. For residual products, the revenue has been £43,785, an increase of £11,309; and in the electric lighting department the revenue has been £3185, an increase of £1067. These figures read well; and with the very foggy weather we have been experiencing, the revenue for this month must show a considerable advance. The coal bill will be heavy, on account of the trouble with the miners; but even taking this into account, there should be a considerable increase of profit, unless the time between this and the close of the financial year should be much worse than it has the appearance of being.

Lord Provost Bell, of Glasgow, has compiled an account of the past year's work of the Corporation, which contains some very interesting reading to those who like to contemplate municipal problems. His Lordship casts up the assets and liabilities of the city; and he shows that, while the former amount to £10,512,226, the latter come to only £7,924,154—leaving the substantial surplus of £2,588,072. Glancing at a table which is given, it is seen that the Gas and Electric Lighting Committee are the owners of the largest liability, their total being £1,857,519; and the Water Department comes next, with a capital of £1,334,948. By the operation of sinking funds, it is shown that the gas liabilities at present existing will be all paid off in the year 1934;

and the water liabilities, in 1964. The latter is the latest period at which, supposing (which is out of the question) no new debts were incurred, the community of Glasgow will be debtors in respect of any public work. The Lord Provost does not lose sight of the fact that fresh liabilities will have to be incurred; but he draws the comforting conclusion, from his study of the Corporation finances, that at a very early date the debt will be greatly reduced, and that there must come a time when they will have fewer great schemes on hand, and will be able to carry on the administration of the city's affairs without the necessity for adding to their responsibilities to the extent witnessed in recent years. Regarding the Gas Department, he points out that they have now had it in their hands for a quarter of a century; and during that time they have been able to reduce the price of gas by 1s. 9·66d. per 1000 cubic feet. Of that, only 5·66d. is attributable to the fall in the price of coal; leaving 1s. 3·94d. as due to improved methods of manufacture, the enhanced value of residual products, and other causes. Reverting to his Lordship's remarks as to the time when their heavy expenditures will be greatly reduced, it may be pointed out that the gas account, while it can never be altogether closed, must, with the completion of the present schemes of reconstruction, be so to a very great extent; and that, with regard to the water account, when the augmented supply is brought in, it will practically be altogether closed for many a year. These two, as forming the largest debts of the Corporation, when they reach that stage will open up a brighter future for the ratepayers.

A fire occurred at the Broughty Ferry Gas-Works in the latter part of last week, which I refrained from mentioning till I should see if it could be explained. It has not yet been so. The fire originated with the apparatus for the supply of oil to the Peebles oil-gas plant. An overflow of oil seems to have been the cause. It took place at three o'clock in the morning; and so any plea of carelessness on the part of the men can scarcely be entertained, because at that hour the superintendence could scarcely be expected to be of the most complete order. An overflow of oil would seem to point to an obstruction in the supply-pipe; but whether there was such or not, it surely indicates that the point where the oil is served to the retorts is dangerously near them. Were it even but a yard or two off, an overflow would result in nothing more than the loss of the oil. Doubtless the Oil Gas Enrichment Company will clear the matter up. The damage which was done was chiefly to the roof of the building, and is estimated at about £65.

I am informed that an installation of the Peebles oil-gas plant has been started at Saltaire, in Yorkshire, and that it is working satisfactorily.

The railway station at Markinch, in Fifeshire, is the first in Scotland to be lighted up by incandescent gas-lamps. The North British Railway Company are experimenting with the light, and have evidently resolved to try its adaptability for platform illumination in a station where there is a moderate quantity of traffic, and any amount of exposure to weather.

The very sensible practice of the Aberdeen Corporation, and which I am sure their Engineer and Manager (Mr. A. Smith) quite appreciates, of taking new members of the Gas Committee round on an official visit of inspection, so as to familiarize them with their work, took place on Wednesday. This year the ceremony had a more than usual interest, in the fact that the large new gasholder which the Corporation have been erecting during the past two years is all but completed; and the Committee had it described to them. The new holder is of 4 million cubic feet capacity; and it has cost about £35,000, of which £22,000 was for ironwork. A feature upon which the Committee plume themselves, and are entitled to do so, is that the whole of the work has been carried out under the direction of Mr. Smith. Mr. Johnston, the Convener of the Committee, said it was just two years since they resolved, at their annual visit, to have the holder erected by men under their own supervision; and he was proud to say that the work had been done very satisfactorily. In about ten days they expected to be ready to blow up the holder. Their greatest satisfaction was that the work had been all along within the estimate. Mr. Smith explained to the company that, whereas the cost of their previously erected gasholders was about £20 per 1000 cubic feet, the cost of this one would be only about £8 per 1000 cubic feet. The new holder would contain about two days' supply of gas for the city. I do not know any other place which is so well equipped with storeage accommodation. After the inspection, the healths of Mr. Johnston, Mr. Smith, and Mr. Murray, the Electrical Engineer, were pledged, and the customary complimentary speeches were delivered. The Barrowfield Iron-Works, Limited, of Glasgow, were the contractors for the supply of the materials for the gasholder.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 8.

Sulphate of Ammonia.—The market shows no recovery from its dull condition; but the fact that parcels offered by tender and otherwise have moved off fairly freely testifies that there is some life left, although slightly reduced prices have had to be conceded. The dealers are, however, masters of the situation at present—the lowering prices leading consumers to the conclusion that "bed-rock" values have not yet been touched; and any requirements which they may have are consequently put off. It will depend upon the quantity still to be put upon the market during the month how the near future will shape; but, for the moment, nothing is being forced for sale, at all events from makers. Values on the whole have not given away much; and the sales have been at £11 12s. 6d. to £11 10s., f.o.b. ports. Nitrate is quiet at 8s. 9d.; and rather lower rates have been taken for cargoes, spring delivery.

LONDON, *Dec.* 8.

Tar Products.—Although the demand for benzols and the deliveries are good, the price is, if anything, a shade weaker; and 1s. 1d. for both qualities is about the current figure. Inquiries for next year's delivery are more frequent; and the probability is that, with the larger outlet for carburetting and the other uses to which it is being applied on account of its low price, values in the coming year may probably be better. Pitch is in good demand, and recent high prices are still being maintained. Creosote and grease oil are both active, and show no evidence of falling off in price. Carbolic acid is weak, with very poor demand. To-day's prices are as follows: Tar, 17s. to 21s. Pitch, prompt, 40s.; forward, 35s. Benzols, 90's,; 50's, 1s. 1d. Solvent naphtha, 1s. 2d. Toluol, 1s. 2½d. Crude naphtha, 5d. Creosote, liquid, 2¼d.; ordinary, 1¼d.; salts, 20s. Cresylic acid, nominal, refined, 1s.; brown, 9d. Carbolic acid, 60's, 1s. 5d. Anthracene, "A," 1s. 1½d.; "B," 10d.

Sulphate of Ammonia has again been weaker; and business has been as low as £11 7s. 6d. For next month and forward delivery, however, buyers appear to be more anxious to cover; and a better price is available. To-day's price ranges between £11 7s. 6d. and £11 12s. 6d., less 3½ per cent.; while gas liquor is offered at 7s. to 9s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Perhaps the most significant indication of the continued exceptionally depressed condition of the coal trade throughout this district that could be afforded, is the fact that one of the leading colliery firms has, with the commencement of the month, announced a reduction in price, not only on the inferior classes of fuel, but also upon the better descriptions of round coal. Although this at present is an isolated case, it is probably without precedent that prices should be reduced with the commencement of December; and other collieries will necessarily have to follow, if they find that their business is being affected by the lower prices which this one large firm is now quoting. The severe weather recently brought forward some increased inquiry for house-fire qualities, but generally not sufficient to make itself appreciably felt; and four days per week remains the full average that pits are working, with some of them not running more than half-time. Supplies of all descriptions of fuel are ample to meet requirements. Best Wigan Arley coals are readily obtainable at 10s. 6d. to 11s. per ton at the pit mouth; Pemberton four-feet and seconds Arley range from 9s. up to 10s.; common house-coals, from 7s. to 8s.; and steam and forge qualities of round coal, are about 6s. 6d. to 7s. The depressed condition of the round coal trade necessarily has some effect upon the quantities of engine fuel coming upon the market; and these are not perhaps quite so excessive a drag as they have been. Supplies are, however, still largely above requirements; and surplus lots are pushed for sale at very low figures. At the pit mouth, ordinary descriptions of Lancashire slack can be bought at 3s. to 3s. 6d., with better qualities quoted at 4s. 6d. to 5s.; and special lots of slack, from outside districts, are offering as low as 1s. 6d. to 2s. per ton at the pit. The shipping trade continues quiet, with common round coal obtainable, delivered at Mersey ports, at 8s. to 8s. 3d. per ton; and better qualities, at 8s. 6d. to 8s. 9d.

Northern Coal Trade.—The coal trade has dropped still further in the last few days, especially as regards steam coals, which are now lower than for many months; whilst other classes of coal are also dull, though not to the same extent. Best Northumbrian steam coals have been quoted as low as 9s. per ton f.o.b., the lowest price of the year; and the rate may be said to vary from that to 9s. 3d. per ton. Steam smalls are 3s. 9d. to 4s. per ton f.o.b.; and second steam, about 8s. 9d. In regard to gas coals, there is a very large delivery at the present, for the gas companies are now preparing stock for the next two weeks, which are usually those of the heaviest consumption in the year. There are rumours of sales below the combination prices; but some of these statements are doubtful, and the quotation is still 7s. to 8s. per ton f.o.b., though it is believed that after the end of the year there will be cargoes obtainable at lower prices. Manufacturing coals are now being largely contracted for over next year; and generally the price is about 6d. per ton below those that have ruled for the current year. In regard to coke, blast furnace coke is selling freely on contract; and the price of best Durham coke for export may be put at from 13s. to 14s. per ton f.o.b. Gas coke is also being now sold for next year's delivery; and it seems probable that when the contracts are all arranged, they will average about 6d. per ton below the price at which the coke has this year been delivered.

Scotch Coal Trade.—Quietness is the prevailing feature of the coal trade this week. There is no perceptible falling off in the amount of business doing; but the prospect does not improve, and the result is easier prices all round. Already the miners have more than met the extraordinary demand which sprang up at the close of the strike; and they are, at some collieries, not able to get full time. Splint coal is abundant, with a tendency to drop in price; and the same may be said of other varieties. The prices quoted are: Main, 7s. 3d. to 7s. 6d. per ton f.o.b. Glasgow; ell, 8s. to 8s. 3d.; splint, 8s. to 8s. 3d.; and steam, 8s. 6d. to 8s. 9d. Shipments amounted to 163,647 tons—an increase over the previous week of 23,370 tons, and an increase as compared with the corresponding week of last year (when there was a strike of miners in Lanarkshire) of 70,431 tons. For the year to date, the total shipments have been 4,809,390 tons—a decrease compared with the quantity in the corresponding period last year of 2,573,726 tons.

Opposition to the Mid-Kent Water Company's Scheme.—A largely attended vestry meeting was held last Friday evening, at Eccles, Kent, to consider the advisability of opposing the application of the Mid-Kent Water Company to the Board of Trade for powers to supply Eccles with water. After considerable discussion as to the likelihood of satisfactory terms being obtained from the Company, the following resolution was carried by a large majority: "That the Clerk be requested to lodge formal notice of opposition to the application of the Mid-Kent Water Company to supply the parish of Aylesford with water, on the ground that, in its opinion, the best means of obtaining a water supply is by sinking an artesian well; and asks him to write to the Malling Rural Sanitary Authority to that effect, and to the Committee of the Malling Rural Sanitary Authority, to take steps to secure joint action between the parish and district authority."

Reduction in the Price of Gas at Oldbury.—The Gas Committee of the Oldbury Local Board have decided to reduce the price of gas 2d. per 1000 cubic feet, as from Jan. 1 next.

The West Bromwich Corporation and the Incandescent Gas-Light.—At the last meeting of the West Bromwich Town Council, the Highway Committee, in their report, stated that they had received a report from the Borough Surveyor with reference to some experiments he had made with the incandescent gas-light for the public lamps, and had instructed him to fix these lights in lamps opposite the public buildings and in some of the leading thoroughfares.

A "Record" Day's Consumption of Gas at Belfast.—Mr. J. Stelfox, the Gas Engineer of the Belfast Corporation, reported to his Committee last Thursday that the darkness in the city on Wednesday resulted in a record output of gas from the works. The quantity delivered during the 24 hours ending midnight was 7,076,000 cubic feet, and exceeded the day's make by more than a million cubic feet—the balance being supplied out of the reserve. This was regarded as showing the absolute necessity for storeage and producing capacity in excess of the normal demand.

The Lighting of Pretoria.—The Pretoria Lighting Company have just had a meeting at which the new contract with the Government, cancelling the electric and gas concessions, and extending the contract for the lighting of the town for 15 years, was adopted, as well as a reconstruction scheme, and an offer from certain gentlemen guaranteeing to advance up to £40,000 on debentures of the Company—the shareholders having the right to participate in the application for debentures *pro ratâ* to their holdings. The report and accounts were also adopted. The new scheme takes effect as from the 1st inst.

Reduction in the Price of Gas at Batley.—A recommendation by the Gas Committee, that the price of gas be reduced by 4d. per 1000 cubic feet, was before the Batley Town Council at their meeting last week. Alderman Brooke, in moving its adoption, stated that for some time past the Committee had transferred £2000 a year from the profits to relieve the rates; and it was now considered that the best plan would be to reduce the price of gas. During the last twenty-one years, during which the Corporation had been in possession of the gas-works, some £28,297 had been handed over from the profits. The minutes were confirmed.

The Plymouth Corporation and the Gas Company.—Among the business on the *agenda* for the meeting of the Plymouth County Borough Council yesterday were two or three items bearing on the relations between the Corporation and the Gas Company. The Works Committee recommended the appointment of Dr. C. E. Bean to test the gas supplied; and they reported that he was willing to accept the position, and to make two tests each week of the illuminating power, two for sulphuretted hydrogen, and one of the pressure. Another deputation, representing owners and occupiers of property in the vicinity of the gas-works, have been to the Sanitary Committee. Like a former deputation which waited on the Town Council, they complained of a serious nuisance arising from the works since the new plant and machinery has been erected and brought into operation; and they requested the Committee to take such action as lay in their power to secure the abatement of the nuisance. Several members of the deputation, it appears, produced various articles of silver and brass which they alleged had been discoloured by the action of the fumes from the works. After hearing the statements of the deputation, the Committee appointed sent one of their members and the Town Clerk to wait on the Gas Company with reference to the matter. The Town Clerk expressed the opinion that it was very doubtful if any action which the Committee could take would secure a complete abatement of the nuisance. He was, however, directed to obtain the opinion of Counsel as to the powers of the Committee in relation to the matter; and he was authorized to institute and carry on such proceedings, if any, as Counsel might advise to secure the abatement and prevent the recurrence of the nuisance, unless the Company abated it in the meantime. A report on the same matter by the Medical Officer of Health was ordered to be sent to Dr. Fryer, the District Inspector under the Alkali, &c., Works Regulation Act.

Mr. Alfred Lass on the London Water Supply.—At the Wesleyan School Room, Upper Richmond Road, on the 29th ult, Mr. Alfred Lass, F.C.A., delivered before the Wesleyan Literary Society a lecture on the above subject. Mr. Lass began by considering the subject from an historical standpoint; and, in clear and forcible language, he sketched ancient London from the time of the Conquest to the present day—showing, by an interesting series of maps, the growth of the City to its present enormous bulk. On the point of increase, it was mentioned that, if London continues to advance at a similar rate to that of the last decade, its population 40 years hence will be 12 millions. Old London Bridge, too, formed a topic of no small interest; for it was in connection with this bridge that the first London water-works were established. Up to the sixteenth century, London was supplied with water from what was called the "River of the Wells." It was not until 1543 that the first London Water Act was passed; but it was not before the reign of James I. that the New River Company was formed, in the success of which the King was largely financially interested. Coming down to the present time, Mr. Lass explained that there are eight Companies engaged in the task of supplying London with its necessary 200 million gallons of water per day for domestic and manufacturing purposes; and it is well estimated that the sources of the present supply—mainly from the Thames and the Lea—will be ample to meet the demands of 40 years hence. The lecturer dealt successively with the question of rainfall and its percolation through the earth to refresh the springs, with the storeage capacity of the Companies, and with the great care that is taken in purifying and clarifying the water so as to make it free from any possible taint; and he was very reassuring when he spoke of the ever-watchful vigilance of the authorities to prevent contamination of the river by sewage or refuse. References to the comparatively very small cost of the water to every inhabitant, and to the need for gratitude that so good a supply is within reach of all, rich and poor, closed a highly instructive discourse. Maps and diagrams well illustrated the lecture, which was heartily applauded.

The Whitby Local Board and the Gas and Water Works.—At the meeting of the Whitby Local Board last Tuesday, Mr. Walker introduced a motion approving the principle of the purchase by the town of the local gas and water works. He contended that the acquisition of the works would be an advantage to the town and the ratepayers. After some discussion, the motion was agreed to almost unanimously; and a Committee was appointed to make the necessary inquiries.

The Gravesend Corporation and the Water-Works.—The Directors of the Gravesend and Milton Water Company have, in reply to communications from the Gravesend Town Council, resolved that it is not expedient to advise the shareholders to sell their undertaking. The Council have, in consequence, appointed a Committee to deal with the subject. This is almost tantamount to shelving it; for a similar Committee in connection with the proposed purchase of the gas-works was appointed several years ago, and the situation is practically unchanged, except perhaps that the Gas Company are more firmly established than ever in their position.

The Burnley Corporation and the Penny-in-the-Slot System.—As briefly mentioned in the JOURNAL last week, the Gas Committee of the Burnley Corporation have decided to adopt the prepayment meter system. The matter came before the Town Council last Wednesday for confirmation. Alderman Collinge, in moving the adoption of the proceedings, observed that the Committee hoped by the new system to reach several thousand householders who were not at present consumers; and he stated that the price was such as to allow of a six hours' supply with a No. 3 burner for a penny. He added that six pennies put in on a Saturday would provide a week's supply. The minutes were approved.

Gas and Water Affairs at Oswestry.—At last week's meeting of the Oswestry Town Council, it was announced that the Local Government Board had granted the application of the Council for a further loan of £2500 required for the purpose of completing the Penygwely water-works. A letter was also read from the Oswestry Gas Company, asking for an increased price per lamp for the street lighting; and suggesting, as an alternative, that the Council should take over the lamps—the Company charging them for the gas supply at the rate of 2s. 8d. per 1000 cubic feet. The offer was not accepted. The Watch Committee were afterwards instructed "to ascertain the cost of erecting gas-works for the town."

The Public Lighting of Dover.—The Dover Town Council lately appointed a Committee to consider the public lighting question. The Gas Company have offered to renew their contract on the present terms; undertaking to keep in condition and paint the existing gas-lamps in the streets where the electric light has been installed at one-third the cost mentioned in the contract, which is 6s. a year for each of the small lamps, and 7s. for the large ones. The Company offer to light some of the important thoroughfares with incandescent lamps, by which they claim that the town will save about £40 per annum, and considerably more if the area should be extended as a result of the present experiment being a success. The contract terminates on the 31st inst. We learn that the Mayor (Sir W. H. Crundall) has tried to influence the Town Council in favour of the Dover Electricity Company, notwithstanding the opposition of several members. At the meeting of the Town Council last Tuesday, the Committee reported the reception of a letter from the Gas Company taking exception to some statements made by the Mayor; and after this letter had been discussed the contract with the Company was renewed for a year.

The Supply of Water for Baths in Manchester.—There was a discussion at last Wednesday's meeting of the Manchester City Council on the question of the supply of water to baths in weekly houses. It was started by Mr. Tunstall, who moved that, from and after March 31, 1895, the charge of 10s. per annum per house now made for water supplied to baths in weekly houses be discontinued. He considered it was an injustice that, while no such tax was placed upon yearly or quarterly houses, it should have to be borne by houses where the rents were paid weekly, and that, on the points of sanitation and cleanliness alone, the abolition of this tax would be one of the greatest improvements Manchester had ever made. Mr. Mainwaring seconded the motion, referring to the tax as a most unjust one. Two or three other members also spoke in support of the resolution. Alderman Sir John Harwood, in reply, remarked that he was well aware that these were the days of advocating all they could get for nothing for everybody. Somebody, however, had to pay. The water-works had cost altogether 5¼ millions; and, speaking roundly, about a million had been repaid. The Thirlmere works would entail an additional tax upon the city of £103,000 per annum; and this would probably, before they had finished with it, rise to £110,000. They had been trying hard for five years to see if they could readjust their financial position, so as to bring the water from Thirlmere to Manchester without any additional public burdens; and they had practically accomplished this. They would have this year about £80,000 towards the £103,000; and perhaps next year they would be able to arrange affairs so that they would have £90,000. The incidence of public taxation of this kind was one of the most difficult tasks that a responsible Corporation could have in hand; and he quite admitted that it was difficult to fix upon any mode of taxation that would be absolutely satisfactory all round. What they had to do, therefore, was to take that course which was open to the fewest objections. There were 7097 baths charged at the rate of 10s. per annum. This gave an income of £3548; and after taking the 20 per cent. off, it left a net revenue from weekly houses of £2838. There were several contractors who had large claims for extra works at Thirlmere; and how these claims would be adjusted, it was at present impossible to say. He therefore thought the present charge had better be continued for about two years. Then they would have the whole financial position before them; and at the end of the two years, he thought they ought to reduce the 10s. to 5s., and so approach as nearly as they could to what was equitable. He thought the 10s. was too much; and though he hoped the Council would not disturb the arrangement just now, he was sure the Committee would, as soon as they saw the financial position fairly secured, do what was right. On this statement, the mover and seconder withdrew the resolution.

The Liverpool Corporation and the Gas Company.—Alderman F. Smith made a statement on the subjects of the reduction of the public lighting and the testing of the gas supply at last Wednesday's meeting of the Liverpool City Council, when moving the adoption of the general proceedings of the Lighting Committee. He said that the new system of lighting, lowering, and extinguishing the public gas-lamps had resulted in a considerable saving. The men were able to do the work in less time; and they were satisfied with their wages and with their hours of labour. A deputation from the Committee, he proceeded to remark, had waited upon representatives of the Company, and requested that the charge for a supply of gas for the public lamps should be lower than the price to private consumers. They were told that the Company had considered the matter, and could make no reduction. They had also applied to the Company to place testing-rooms, in accordance with the Act of 1865, in various parts of the city; so that the gas could be tested at different points when it came from the works. The Company had replied that they were only compelled by the Act to provide one public testing-room—the one they now had at the Municipal Offices. He thought this showed how very badly Liverpool was placed with regard to the Company. The Corporation had the distinct right to object to the gas being in one part of the city 23-candle power and in another part 17 or 18 candle power. Dr. Clarke remarked that out of 70 men employed in connection with the public lighting, 50 were absolutely new to the work; and this was considered to be a serious injustice to the old hands. Mr. Brownbill, the Chairman of the Watch Committee, stated that the Committee were still prepared to take on the old hands (provided they were efficient and equal to the work), in comparison with others who applied. Alderman T. Hughes thought it should go forth that there was no idea of keeping the men who had been employed by the Gas Company out of work so long as they were fit for it, and were properly recommended. The proceedings of the Committee were adopted.

Johannesburg Water-Works, &c., Company.—A meeting of the British shareholders in this Company was held last Wednesday, at Winchester House, E.C. (Mr. W. G. Soper, J.P., in the chair), for the purpose of selecting six names for submission to the head office at Johannesburg, from which to choose five gentlemen for appointment as the London Board. The Chairman, in opening the proceedings, remarked that the test of a water undertaking in South Africa was its power to resist a strain on its resources arising from drought. There had been a severe and general drought in South Africa; but, nevertheless, the town of Johannesburg had not wanted for water, either in quantity or quality. Mr. Barnato subsequently addressed the meeting, and repeated the belief he had formerly expressed in the future of the Company. When it was first formed, the phenomenal growth of Johannesburg which had been witnessed was never anticipated. At the outset, they had to supply a population of 6000; but within the last five years, the town had developed into a population of nearly 50,000. It might be said that they would have to meet with the opposition of a rival company; but even if they were so threatened, they need not, he said, have the least fear or anxiety, for they had done everything they could to meet all possible requirements of the population—providing reservoirs and storeage capacity—and they had also secured the sole right of supplying the principal water consumers of the town and its suburbs for the next 80 or 90 years. Any opposing company would have to bring water from a distance of 50 miles. The only rival scheme they had heard of would cost £600,000; and it could never pay, as there would be so few water consumers to supply. Irrespective of the value of the water undertaking, they had their land, which was purchased when property was not a tenth of its present value. In answer to a question, Mr. Barnato stated that the Directors had no proposal before them from the Sanitary Board for the acquisition of their property. A resolution was passed returning the names of the gentlemen constituting the present London Board.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. iiii.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	**GAS COMPANIES.**				£ s. d.
590,000	10	11 Oct.	10½	Alliance & Dublin 10 p. c.	10	19—20	..	5 5 0
100,000	10	,,	7⅞	Do. 7 p.c	10	13¼—14¼	..	5 3 5
500,000	100	2 July	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 4
200,000	5	14 Nov.	6¼	Bombay, Limited	5	6—6⅛	..	5 0 0
40,000	5	,,	6¼	Do. New	4	4⅛—4⅜	..	5 9 6
380,000	Stck.	15 Aug.	11½	Brentford Consolidated	100	233—238	..	4 16 8
180,000	,,	,,	8½	Do. New	100	183—188	..	4 10 5
220,000	Stck.	28 Sept.	11	Brighton & Hove Original	100	215—220	..	5 0 0
888,500	Stck.	30 Aug.	5	Bristol	100	115—120	..	4 3 4
320,000	20	28 Sept.	11½	British	20	4⅜—4⅝	−⅛	4 11 5
50,000	10	30 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½—22½	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½—17½	..	4 17 2
528,750	10	14 Nov.	2	Buenos Ayres (New) Limited	10	6⅛—6⅜	−⅛	2 19 3
200,000	100	2 July	6	Do. 6 p. c. Deb.	100	101—103	..	5 15 5
150,000	20	12 July	8	Cagliari, Limited	20	27—28	+1⅛	5 14 3
550,000	Stck.	11 Oct.	13	Commercial, Old Stock	100	272—277	..	4 13 10
165,000	,,	,,	10	Do. New do.	100	200—2 5	..	4 17 7
160,762	,,	14 June	4½	Do. 4½ p c. Deb. do.	100	132—137	..	3 5 8
800,000	Stck.	14 June	13	Continental Union Limited	100	243—248	..	5 4 10
200,000	,,	,,	10	Do. 7 p. c. Pref	100	210—215	..	4 13 0
535,000	Stck.	30 Aug.	5	Crystal Palace Ord. 5 p.c. Stk	100	115—120	..	4 3 4
486,090	10	27 July	11	European, Limited	10	22⅛—23⅛	..	4 13 7
354,060	10	,,	11	Do. Partly paid	7½	16—17	..	4 17 1
5,646,590	Stck.	15 Aug.	12	Gaslight & Coke, A, Ordinary	100	250—254	..	4 14 5
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105—110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	277—282	..	3 10 10
30,000	,,	,,	5	Do. F, 5 p. c. Pri.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	182—187	..	3 14 11
4 63,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	275—280	..	3 11 5
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	14 June	4	Do. 4 p. c. Deb. Stk.	100	128—131	..	3 1 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	135—140	..	3 4 3
908,000	,,	,,	6	Do. 6 p. c. do	100	187—192	+2	3 2 6
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	223—228	−1	5 5 3
75,000	5	14 June	6	Malta & Mediterranean, Ltd.	5	5—5⅛	..	5 9 1
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	110—112	..	4 9 3
541,920	20	14 Nov.	5	Monte Video, Limited	20	15—16	..	6 5 0
150,000	5	29 Nov.	8	Oriental, Limited	5	7—7⅛	..	5 6 8
60,000	5	13 Sept.	7	Ottoman, Limited	5	4¼—4½	..	7 7 4
166,870	10	31 Jan.	2	Park Limited	10	1¾—2	..	10 0 0
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	100—105	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	95-100	..	6 0 0
150,000	10	11 Oct.	5	San Paulo, Limited	10	8¾—9¼	−¼	5 9 10
500,000	Stck.	30 Aug.	15½	South Metropolitan, A Stock	100	337—342	..	4 10 8
1,350,000	,,	,,	12	Do. B do.	100	283—288	..	4 3 4
260,000	,,	,,	13	Do. C do.	100	292—297	..	4 7 6
750,000	,,	12 July	5	Do. 5 p. c. Deb. Stk.	100	157—162	..	3 1 9
60,000	Stck.	30 Aug.	11½	Tottenham & Edm'nton, "A"	100	220—225	..	5 2 2
				WATER COMPANIES.				
746,011	Stck.	28 June	10	Chelsea, Ordinary	100	290—295	..	3 7 10
1,719,514	Stck.	11 Oct.	8	East London, Ordinary	100	232—237	..	3 7 7
654,740	,,	28 June	4½	Do. 4½ p. c. Deb. Stk.	100	152—156	..	2 17 8
700,000	50	14 June	8½	Grand Junction	50	120—124	..	3 8 7
708,000	Stck.	15 Aug.	12	Kent	100	305—310	+1	3 17 5
1,043,800	100	28 June	9½	Lambeth, 10 p. c. max.	100	271—276	+1½	3 8 10
406,200	100	,,	7½	Do. 7½ p. c. max.	100	209—214	..	3 10 1
330,000	Stck.	28 Sept.	4	Do. 4 p. c. Deb. Stk.	100	132—135	..	2 19 3
500,000	100	15 Aug.	12½	New River, New Shares	100	384—388	..	3 2 6
1,000,000	Stck.	27 July	4	Do. 4 p. c. Deb. Stk	100	140—145	..	2 15 2
902,300	Stck.	14 June	6	S'thwk & V'xhall, 10 p. c. max.	100	170—175	..	3 8 7
126,500	100	,,	6	Do. D 7½ p. c. do.	100	160—165	..	3 12 9
1,155,066	Stck.	14 June	10	West Middlesex	100	280—284	..	3 10 5

*Ex div.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 2698.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM, PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications re OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 200 British Gas-Works. [See Advt., p. 1143.]
ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C. Telegrams: "Volcanism, London."

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.
BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

AS Secretary and Accountant, or Assis-tant. Advertiser desires engagement in either capacity. Fifteen years' secretarial experience. Good address. Excellent testimonials as to business qualifications.
Address No. 2456, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ASSISTANT Engineer and Manager desires engagement as GAS MANAGER or SUB-MANAGER. Fifteen Years' experience, London and Provinces. Holds First-Class Honours in "Gas Manufacture" (City and Guilds Institute), and many Technical Awards. Excellent Testimonials as to Character and Qualifications.
Address No. 2463, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a suitable Man as Main and SERVICE LAYER. One with a knowledge of Fitting preferred. Only those who are used to the work need apply.
Apply, by letter, stating Age and Wages required, and enclosing (copies only) of Testimonials to R. T. SIMPSON, Secretary, Gas Offices, Guildford, SURREY.

WANTED, two Junior Clerks (about 20 years of age) in the Office of a Suburban Gas Company. Must be thoroughly well up in the routine of the Rental Department.
Apply, in own handwriting, stating all particulars as to Age, Experience, and Salary required, to No. 2464, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TEN-HORSE Power "Trusty" Gas-ENGINE, by Weyman, FOR SALE. Cost £220 two years ago. Will be sold for half-price, to clear at once. Guaranteed in good working order.
Apply to W. BIRCH, HIGH WYCOMBE.

FOR SALE—Second-Hand Telescopic GASHOLDER, 60 ft. diameter by 10 ft. 6 in. deep each Lift, in Cast-Iron Tank.
Price and all Particulars on application to No. 2461, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Rotary Scrubber Washer.
Capacity 500,000 Cubic Feet per diem. Only worked a short period, and taken out to be replaced by a larger one.
Apply, by letter, to No. 2460, care of Mr. King, 11 Bolt Court FLEET STREET E.C.

THE Directors of the Worksop Gas Company invite TENDERS for the purchase of the surplus TAR and the AMMONIACAL LIQUOR made at their Works, from the 1st of January to the 31st of December, 1895.
Tenders for Tar to state price per ton delivered into Purchasers' Tanks at the Worksop Railway Station. Tenders for Liquor to state price per ton, as tested by No. 1 Twaddell's Hydrometer, delivered into boats near the Company's Works.
The Directors do not bind themselves to accept the highest or any tender.
Tenders to be sent in by the 27th of December.
Worksop, Dec. 1, 1894.

W. C. HOLMES & CO., Huddersfield; AND 60, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. III., centre of JOURNAL.
Cablegrams: "Igniter London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.
GAS PLANT CEMENT
FOR ALL LEAKAGES.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

SADLER AND CO., LIMITED,
MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

BRICK GASHOLDER TANK.

TENDERS are invited for a Brick Gas-HOLDER TANK, 36 ft. diameter by 14 ft. 3 in. deep.
Specification and Drawing can be inspected at the Offices of the undersigned on and after Tuesday, the 4th of December, to whom tenders, endorsed "Tender for Brick Tank," must be delivered on or before Monday, the 24th of December, 1894.
SAMUEL WHILE.
60, Queen Victoria Street, E.C.

OLDBURY LOCAL BOARD OF HEALTH.
(GAS DEPARTMENT.)

THE Gas Committee of the above Board are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works for a period of One, Two, or Three Years, as they may think fit, from the 1st day of January, 1895.
Further Particulars may be obtained from the undersigned.
Tenders, sealed and endorsed "Tender for Tar," addressed to the Chairman of the Gas Committee, to be delivered to me not later than Monday, Dec. 17 inst.
The Committee do not bind themselves to accept the highest or any tender.
A. COOKE,
General Manager.
Gas-Works, Oldbury,
Nov. 28, 1894.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS from Ironfounders, Gun-Barrel Manufacturers, Timber Merchants, Druggists, Ropemakers, &c., for GOODS, to be delivered on the Company's Works, Great Brunswick Street, in such quantities as may be required from time to time up to the 31st of December, 1895.
Samples of Goods required are open to inspection on the Works, Great Brunswick Street; and printed Lists of Articles required can be had on application at the Company's Offices, D'Olier Street.
Tenders, endorsed "Tender for Stores," to be lodged in my Office on or before the 27th inst.
W. F. COTTON,
Secretary and Manager.
D'Olier Street, Dublin,
Dec. 8, 1894.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality
Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

JOHN RILEY & SONS, Chemical Manu-facturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

TO RETORT & FIRE-BRICK MANUFACTURERS.

THE Corporation of Bury are prepared to receive TENDERS for RETORTS, FIRE-BRICKS, and FIRE-CLAY required at their Gas-Works.
Forms of Tender may be obtained from Mr. W. H. S. Gendall, Gas Engineer, Gas-Works, Elton, Bury.
Tenders, sealed and endorsed "Tender for Retorts," &c., to be sent to me not later than Monday, the 17th day of December, 1894.
JOHN HASLAM,
Town Clerk.
Bury, Dec. 3, 1894.

RAMSGATE CORPORATION.
(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for about 1700 feet of Stourbridge or other approved quality FIRE-CLAY RETORTS, 22 in. by 16 in., 5000 FIRE-BRICKS, TILES, and 10 tons of CLAY.
Tenders to be sent in on or before Noon on Monday, Dec. 17, 1894, addressed to the Chairman of the Gas and Water Accounts Committee, Hardres Street, Ramsgate, endorsed "Tenders for Fire-Clay Goods."
Specification and full Particulars on application to
WILLIAM A. VALON,
Engineer.

CORPORATION OF ABERAVON.

THE Gas Committee of the above Cor-poration are prepared to receive TENDERS for—
1. One single-flued CORNISH STEAM-BOILER 12 ft. long, 6 ft. diameter, 3 ft. 3 in. diameter Flue, with all necessary Mountings complete. Tested to 120 lbs. Hydraulic Pressure.
2. One VERTICAL STEAM-ENGINE, on Bed-Plate, Cylinder 8 in. diameter, with Fly-Wheel, Feed-Pump, Governors, Lubricators, &c., complete.

Any further Particulars required may be obtained from the Manager, Mr. G. W. Harrison, Aberavon.
Sealed Tenders and Specifications, endorsed "Tender for Boiler," or "Tender for Engine," as the case may be, must be sent to the undersigned on or before the 24th of December, 1894.
No tender necessarily accepted.
By order,
M. TENNANT,
Town Clerk.

BOROUGH OF BURTON-UPON-TRENT.

FIRE-CLAY GOODS.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, invite TENDERS for the supply of the FIRE-CLAY RETORTS, BRICKS, and CLAY required at the Gas-Works during the Year 1895.
Full Particulars of the Specifications and Conditions, with Form of Tender, may be obtained on application to the undersigned, to whom sealed tenders, endorsed "Fire-Clay Goods," must be delivered on or before Friday, the 21st day of December inst.
The lowest or any tender will not necessarily be accepted.
F. L. RAMSDEN,
Manager and Engineer.
Gas and Electric Light Works,
Burton-upon-Trent,
Dec. 1, 1894.

SOUTHEND GAS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company so far as they relate to the FOUR PER CENT. PERPETUAL DEBENTURE STOCK WILL BE CLOSED at Ten o'clock forenoon on Friday, the 14th inst., for the Half Year ending on the 31st of December, 1894, and will be RE-OPENED on Monday, the 17th inst.
The Interest for the Half Year will be payable on the 1st day of January, 1895, to the Proprietors registered on the closing of the Books.
By order of the Board,
JAS. T. RANDALL,
Secretary.
Offices of the Company:
High Street, Southend,
Dec. 7, 1894.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS in respect to the DEBENTURE STOCK WILL BE CLOSED on the 17th of December inst., and RE-OPENED on the 1st day of January, 1895.

By order,
I. A. CROOKENDEN,
Secretary.

St. Helen's Place, Bishopsgate, E.C.,
Dec. 8, 1894.

WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of the Company, so far as the DEBENTURE STOCK only is concerned, WILL BE CLOSED on and from the 22nd of December, 1894, until the 3rd of January, 1895, both days inclusive.

By order,
WALTER CROMARTY,
Secretary.

Offices: North Street,
Wandsworth, S.W., Dec. 7, 1894.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCKS and BONDS, WILL BE CLOSED at Four o'clock p.m. on Monday, the 10th prox., for the Half Year ending on the 31st prox., and will be RE-OPENED on the Morning of Tuesday, the 11th prox.

The Interest for the Half Year will be payable on the 1st of January next, to the Proprietors registered on the closing of the Books.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., Nov. 28, 1894.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company so far as they relate to the FOUR PER CENT. PERPETUAL DEBENTURE STOCK WILL BE CLOSED at Ten o'clock forenoon, on Friday, the 14th inst., for the Half Year ending on the 31st of December, 1894, and will be RE-OPENED on Monday, the 17th inst.

The Interest for the Half Year will be payable on the 1st day of January, 1895, to the Proprietors registered on the closing of the Books.

By order of the Board,
JAMES RANDALL,
Secretary.

Gas Offices: Willoughby Lane,
Tottenham, Dec. 1, 1894.

SOUTH METROPOLITAN GAS COMPANY.

SALE BY TENDER OF £25,000 FIVE PER CENT. PERPETUAL DEBENTURE STOCK.
MINIMUM PRICE £157 PER CENT.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER £25,000 of 5 per Cent. PERPETUAL DEBENTURE STOCK, in accordance with the Provisions of the South Metropolitan Gas Act, 1882.

Particulars of same, with Form of Tender, can be obtained at this Office on application to the undersigned; and tenders must be sent in on or before Tuesday, the 18th day of December next.

The Stock will be allotted to the highest bidders; but no tender will be accepted at a lower price than at the rate of £157 money for each £100 Debenture Stock.

By order,
FRANK BUSH, Secretary.

Office: 709A, Old Kent Road, S.E.,
Nov. 16, 1894.

KENT WATER-WORKS COMPANY.

SALE BY TENDER OF £20,000 FIVE PER CENT. DEBENTURE STOCK.
MINIMUM PRICE £166 PER CENT.

THE Directors invite Tenders for the Issue on Sale, to the highest bidders, of £20,000 of FIVE PER CENT. PERPETUAL DEBENTURE STOCK, authorized to be raised under the Kent Water-Works Act, 1877.

The Total Ordinary Capital is £868,000; and the existing Mortgage Capital, £42,000.

Tenders must be sent in on or before Tuesday, the 18th of December.

Forms, with Particulars and Conditions, may be obtained on application to the Secretary.

Tenders below the minimum price of £166 for each £100 of Stock cannot be accepted.

By order of the Directors,
ALEXANDER DICKSON,
Secretary of the Company.

Kent Water-Works Offices, Mill Lane,
Deptford, S.E., Nov. 30, 1894.

BY ORDER OF THE DIRECTORS OF CROYDON COMMERCIAL GAS AND COKE COMPANY.

SALE OF £13,750 FIVE PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. HOOKER and WEBB have received instructions to SELL BY AUCTION at the Auction Mart, Tokenhouse Yard, London, E.C., on Tuesday, the 18th of December, 1894, at Two o'clock precisely, in 138 lots, £13,750 FIVE PER CENT. PERPETUAL DEBENTURE STOCK of the Croydon Commercial Gas and Coke Company, to be created under the Provisions of the Croydon Gas Act, 1894. The security is ample; and the sale is an unusually good opportunity to Trustees and Capitalists of making a permanent and safe Investment.

Particulars and Conditions of Sale may be obtained of W. J. RUSSELL, Esq., the Secretary, at the Offices of the Company, Katharine Street, CROYDON; Messrs. BLYTH, DUTTON, HARTLEY, AND BLYTH, Solicitors, 112, Gresham House, LONDON, E.C., and of the AUCTIONEERS, 4, High Street, CROYDON.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS, so far as they relate to DEBENTURE STOCK only, WILL BE CLOSED on the 18th inst., and RE-OPENED on the 1st of January, 1895.

S. J. WILLIAMS,
Secretary.

63, Chancery Lane, W.C.,
Dec. 10, 1894.

EAST LONDON WATER-WORKS COMPANY.

ISSUE OF £100,000 3 PER CENT. DEBENTURE STOCK. MINIMUM PRICE, PAR.

NOTICE is Hereby Given, that the Directors are prepared to receive TENDERS for the above Issue (being the First portion of the £500,000 DEBENTURE STOCK, created under the East London Water-Works Company's Act of 1894), bearing Interest at 3 per cent. per annum, less income-tax, and redeemable after the expiration of 25 years from the date of issue, subject to six months' notice being given by the Company. Minimum price, par.

Tenders must be delivered at the Company's Offices St. Helen's Place, Bishopsgate Street, E.C., not later than Eleven a.m., on Thursday, the 13th day of December ensuing.

Particulars and Conditions, together with Form of Tender, may be obtained at the said Offices, or will be forwarded on application.

By order of the Court of Directors,
I. A CROOKENDEN,
Secretary.

St. Helen's Place,
Bishopsgate Street, E.C.,
Nov. 15, 1894.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly 600,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

HARCOURT'S COLOUR TEST.
For Carbon Bisulphide, Sulphuretted Hydrogen, and Carbonic Acid in Coal Gas.

The Materials for the above Tests may be obtained from
Mr. S. E. MILLER, 115, Cowley Road, Oxford.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

NOTICE.

TO GAS ENGINEERS AND OTHERS.

MESSRS. CLAPHAM BROS., Limited, Keighley, Yorkshire, are no longer authorized to Manufacture my CONDENSER and WASHER-SCRUBBERS.

The above-named Gas Apparatus are erected and giving entire satisfaction at the following places: Neath, Lincoln, Sheffield, Ellesmere, Mountain Ash, Malden, Cullingworth, Montreal (Canada), Woodstock (South Africa), Cape Town (South Africa), &c.

These Appliances can now be obtained solely of the undersigned.

J. A. KELMAN.

Winchester House, London, E.C.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton	10,500 cubic feet.
Illuminating Power	16·4 candles.
Coke	68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.
B Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

CAST-IRON PIPES
FOR GAS AND WATER.

Pipes, One to Six Inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES
FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."
WM. MACLEOD & CO.,
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Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

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Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

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Yield of Gas per ton	10,500 cub. ft
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These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
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Strongly recommended where EXCESSIVE HEATS have to be maintained.

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FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.
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Making preparations to adopt
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Available output up to 5000 tons per day,
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
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WORKED BY THE
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The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,300 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]
TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
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Messrs. The
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For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

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Rich in Illuminating Power & Yield of Gas.
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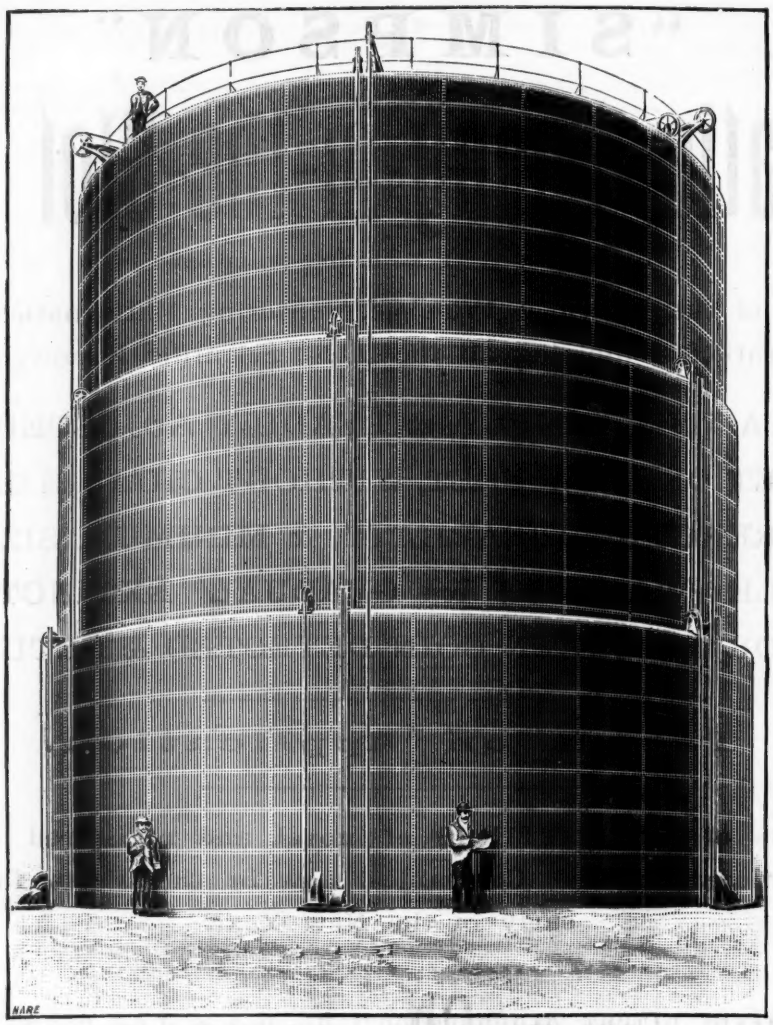

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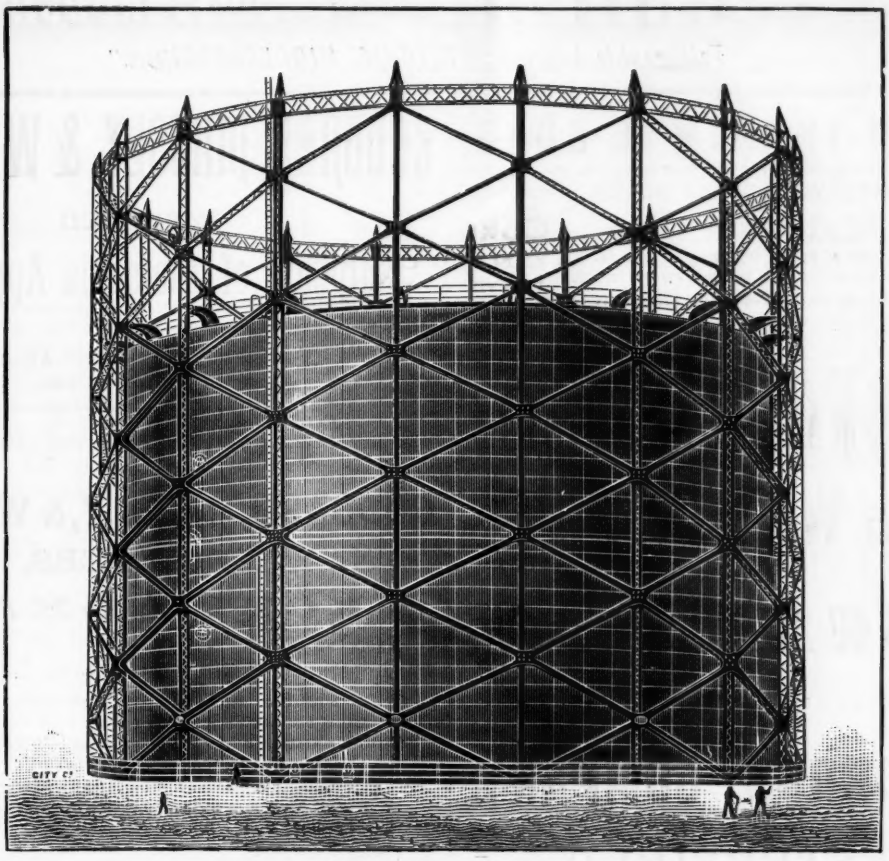

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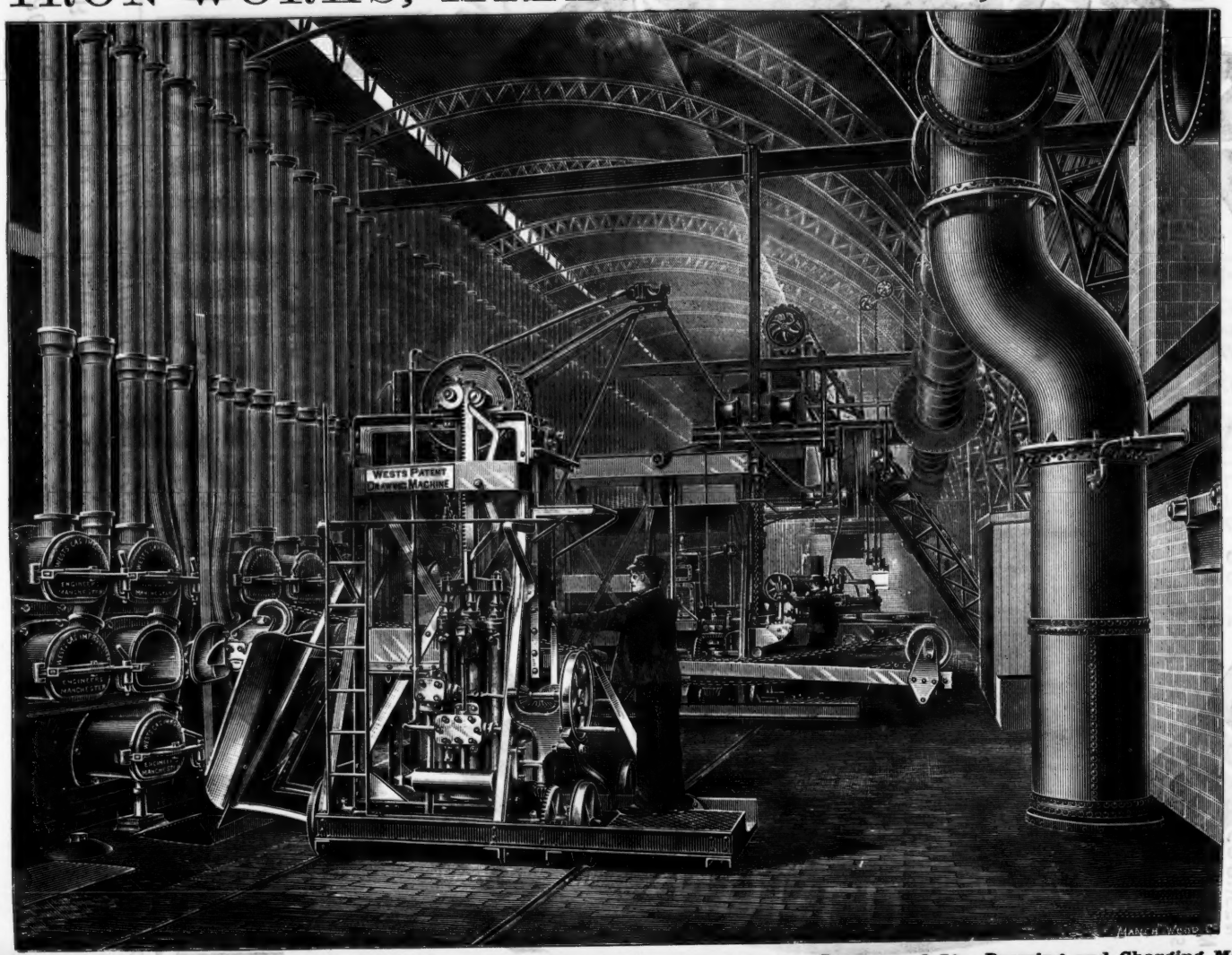

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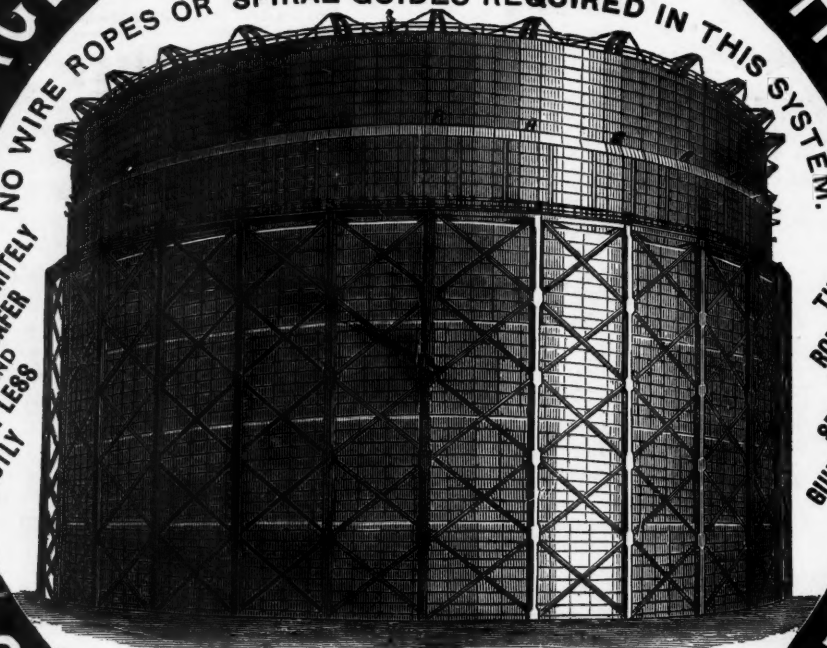

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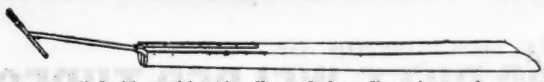

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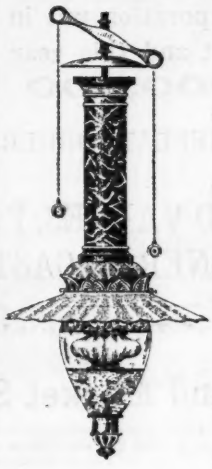

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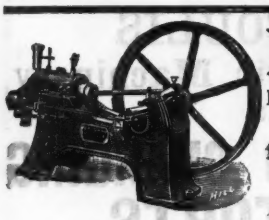

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